LOW SEXUAL DESIRE IN WOMEN

An Empirical Investigation of Predictors and Psychological Treatment
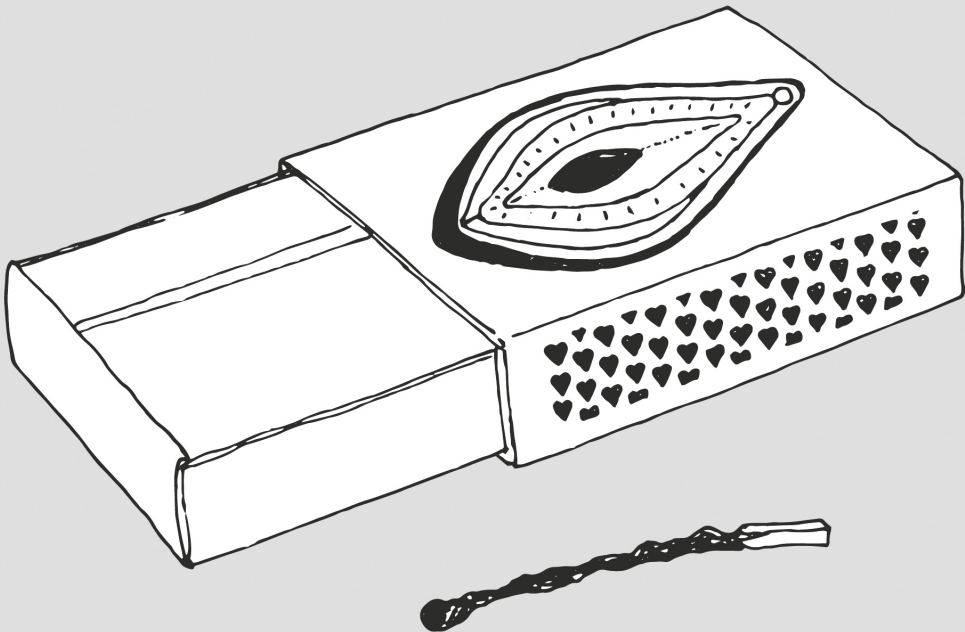
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An Empirical Investigation of Predictors and Psychological Treatment

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TIIVISTELMÄ

Tämän väitöskirjan tarkoituksena oli 1) selvittää naisten seksuaalisen halun ajallista vakautta ja alhaisen seksuaalisen halun ennustajia, sekä 2) arvioida psykologisia interventioita naisten alhaisen seksuaalisen halun hoitoon. Ensimmäisen tavoitteen saavuttamiseksi tehtiin kaksi tutkimusta, joissa sovellettiin pitkittäis-rakenneyhtälömalleja ja verkostoanalyysimalleja suomalaiseen väestöpohjaiseen aineistoon. Aineisto perustui 2173:n naisen ($M_{ikä}$ = 25,5 vuotta, SD = 5,0) kyselyvastauksiin, jotka kerättiin kahtena ajankohtana vuosina 2006 ja 2013. Toisen tavoitteen saavuttamiseksi tehtiin tutkimus, jossa arvioitiin kaksi psykologista interventiota kliinisessä otoksessa Tukholmassa ja Turussa. Otos koostui 70 naisesta ($M_{ikä}$ = 39,2 vuotta, SD = 9,8). Kliiniseen tutkimukseen osallistujilla seksuaalinen halu oli laskenut tavalla, joka tuntui ahdistavalta.

Väestöpohjaisessa aineistossa seksuaalisen halun taso vaihteli merkittävästi ajan myötä, ja suurin osa seksuaalisen halun vaihtelusta selittyi muulla kuin seksuaalisen halun aikaisemmalla tasolla. Parisuhteella oli merkittävä rooli seksuaalisen toiminnan sekä seksuaalisen halun muutosten suhteen. Verkostomalleissa oli viitteitä siitä, että tyytymättömyys omaan kehoon ja yhdyntäkipu toimivat alhaisen seksuaalisen halun ennustajina. Kumpaankin interventioon osallistujien seksuaalinen halu nousi. Lisäksi toissijaisissa muuttujissa havaittiin muutosta. Seksuaalinen ahdistus väheni ja seksuaalinen tyytyväisyys lisääntyi. Noin puolet niistä osallistujista, jotka osallistuivat intervention jälkeiseen kyselyyn saavuttivat kliinisesti merkittävän muutoksen seksuaalisessa halussa, mikä viittaa hoitovasteen vaihtelevuuteen yksilöiden välillä.

Näiden tutkimustulosten perusteella interventioiden käyttäminen alhaiseen seksuaaliseen haluun vaikuttaa lupaavalta, sillä tuloksemme osoittavat että seksuaalinen halu on muuttuva ominaisuus. Tuloksemme viittaavat siihen että parisuhteeseen liittyvät tekijät olisi otettava huomioon psykologisissa interventioissa. Suosittelemme myös aikasarjaverkostoihin perustuvia yksilölle räätälöityjä interventioita.

Asiasanat: alhainen seksuaalinen halu, seksuaalinen toiminta, seksuaaliset toimintahäiriöt, naiset, ajallinen vakaus, ennustajat, rakenneyhtälömalli, verkostoanalyysi, hoito

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ABSTRACT

The present thesis aimed at 1) investigating the change over time in levels of sexual desire as well as predictors of low sexual desire in women, and 2) evaluating brief psychological treatment interventions for women with low sexual desire. To achieve the first aim, cross-lagged structural equation models and network analysis models were fitted to a population-based data set with responses from 2,173 Finnish women (M_{age} = 25.5 years, SD = 5.0). The aforementioned data set included two waves of data collected seven years apart. To achieve the second aim, two psychological intervention conditions were evaluated in a clinical sample of 70 women (M_{age} = 39.2 years, SD = 9.8) from Stockholm, Sweden, and Turku, Finland. Participants in the clinical study reported low and distressing sexual desire before treatment took place.

In the population-based sample, reported levels of sexual desire were highly variable over time, with most of the variance being accounted for by something else than previous levels of sexual desire. Relationship status played a significant role with regards to sexual function and changes in levels of sexual desire. Body dissatisfaction and intercourse-related pain showed network patterns suggesting that they might predict decreases in sexual desire. Participants in both intervention conditions showed significant improvements in sexual desire as well as secondary outcomes such as sexual distress and sexual satisfaction. Approximately half of the participants who provided responses after the intervention reached a clinically significant change in sexual desire, suggesting inter-individual variability in treatment response.

Interventions for low sexual desire in women seem promising, as our results point towards sexual desire being a changeable trait. Our results suggest that relationship-related factors should be taken into account in psychological interventions for low sexual desire. Tailored interventions based on individual time-series networks are also encouraged.

Keywords: low sexual desire, sexual function, sexual dysfunctions, women, temporal stability, predictors, structural equation modeling, network analysis, treatment

Acknowledgments

Table of contents

List of original publications

The present thesis is based on the following original peer-reviewed publications.

I   Gunst, A., Ventus, D., Kärnä, A., Salo, P., & Jern, P. (2017). Female sexual function varies over time and is dependent on partner-specific factors: a population-based longitudinal analysis of six sexual function domains. *Psychological Medicine, 47,* 341–352.[a]

II   Gunst, A., Werner, M., Waldorp, L. J., Laan, E. T. M., Källström, M., & Jern, P. (2018). A network analysis of female sexual function: comparing symptom networks in women with decreased, increased, and stable sexual desire. *Scientific Reports, 8,* 15815.[b]

III   Gunst, A., Ventus, D., Arver, S., Dhejne, C., Görts-Öberg, K., Zamore-Söderström E., Jern, P. (2018). A Randomized, Waiting List-Controlled Study Shows that Brief, Mindfulness-based Psychological Interventions Are Effective for Treatment of Women's Low Sexual Desire. *Journal of Sex Research.* Advance online publication. https://doi.org/10.1080/00224499.2018.1539463[a]

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Abbreviations

ANCOVA	Analysis of covariance
AUDIT	The Alcohol Use Disorders Identification Test
BSI-18	The Brief Symptom Inventory-18
DASA	The Desired and Actual Sexual Activity Scale
DSFI(-BI)	The Derogatis Sexual Function Inventory (body image subscale)
DSM-5	The Diagnostic and Statistical Manual of Mental Disorders, 5th revision
EBIC	Extended Bayesian Information Criterion
FDA	The U.S. Food and Drug Administration
FSDS(-R)	The Female Sexual Distress Scale (-Revised)
FSFI	The Female Sexual Function Index
FSIAD	Female sexual interest/arousal disorder
GSA	The Genetics of Sexuality and Aggression data set
HSDD	Hypoactive sexual desire disorder
ICD-10/11	The World Health Organization's International Statistical Classification of Diseases and Related Health Problems, 10th/11th revision
ITT	Intention-to-treat
MB	Mindfulness-based treatment condition
MLR	Maximum-likelihood estimation with robust standard errors
NCT	Network Comparison Test
PP	Per-protocol
PRQC	The Perceived Relationship Quality Components Inventory short form
RDAS	The Revised Dyadic Adjustment Scale
SDI-2	The Sexual Desire Inventory-2 short form
SEM	Structural equation modeling
SIDI-F	The Sexual Interest and Desire Inventory Female
SOI	The Sociosexual Orientation Inventory
SS	Scheduled sex and motivations for sex treatment condition
STTS-R	The Satisfaction With Therapy and Therapist Scale-Revised
T1	The first measurement point of the GSA data set (2006)
T2	The second measurement point of the GSA data set (2013)

1 Introduction

Difficulties related to low sexual desire are common among women, with 7–23% of women reporting low sexual desire together with feelings of distress (Burri & Spector, 2011; Shifren, Monz, Russo, Segreti, & Johannes, 2008; Witting, 2008). Low sexual desire is further associated with negative aspects such as lower sense of wellbeing (Laumann, Paik, & Rosen, 1999), lower general health (Naeinian, Shaeiri, & Hosseini, 2011), and lower relationship satisfaction (Witting, Santtila, Alanko, et al., 2008), underlining the importance of a better understanding of the nature of low sexual desire, as well as the urgency with which efficient treatment interventions should be developed for distressing low sexual desire. Several biological, psychological, interpersonal, and sociocultural factors are thought to affect the levels of sexual desire (Khajehei, Doherty, & Tilley, 2015), but the complex nature of low sexual desire and its relationship with its various correlates are still poorly understood. The majority of published empirical studies are cross-sectional. Lately, there has been a revival in the scientific field of psychotherapeutic treatments for distressing low sexual desire (Brotto, 2017). There are, however, only a few published controlled studies to date, and the methodological standards of the studies and reported effects on sexual desire vary notably.

The present thesis is based on three empirical studies: two in which the change over time in levels of sexual desire and predictors of low sexual desire in women are investigated, and a third study evaluating psychological treatment interventions for sexual desire difficulties in women. In these studies, we used a large, longitudinal population-based survey data set provided by Finnish women in two waves of data collection conducted seven years apart, as well as a clinical sample consisting of women fulfilling the criteria of a sexual desire disorder.

Although the studies included in the present thesis include other domains of sexual function, the main focus of the present thesis was set on low sexual desire – usually reported as the most common sexual complaint among women (Burri & Spector, 2011; Shifren et al., 2008; Witting, 2008). A brief review of other domains of sexual function and dysfunction is nonetheless provided in the literature review, in order to help the reader follow discussions relating to other sexual function

domains, and in order to connect the topic of sexual desire to the broader field of sexual function and dysfunction.

1.1 Female sexual function and dysfunction

Sexual functions broadly refer to bodily reactions related to different stages of sexual activity. Sexual dysfunctions refer to distressing difficulties related to any of these stages. The categorization of sexual functions and dysfunctions in women has varied ever since Masters and Johnson (1966) published their original (gender-non-specific) model of the sexual response cycle, where they categorized the different physiological stages as excitement, plateau, orgasm, and resolution. Since then, sexual functions in women have come to include aspects of the sexual response that are not considered purely physiological (e.g., sexual desire). However, different diagnostic manuals as well as non-diagnostic assessment questionnaires use slightly different classifications and definitions, and the nosology of sexual functions remains ever-changing and no unanimous consensus regarding their definitions has yet been achieved.

According to the 5th revision of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), which is currently used by physicians in the United States and elsewhere, sexual dysfunctions in women are divided into three overarching categories: female sexual interest/arousal disorder (FSIAD), female orgasmic disorder, and genito-pelvic pain/penetration disorder. The 10th revision of the World Health Organization's International Statistical Classification of Diseases and Related Health Problems (ICD-10; World Health Organization, 1992), on the other hand, is currently used by physicians in most European countries including Finland. According to the latest update of the ICD-10 (World Health Organization, 2016) sexual dysfunctions in women are categorized as lack or loss of sexual desire, sexual aversion (i.e., fear and avoidance of sexual activity) and lack of sexual enjoyment, failure of genital response (i.e., vaginal dryness or failure of lubrication), orgasmic dysfunction, nonorganic vaginismus (i.e., spasms of muscles surrounding the vagina), nonorganic dyspareunia (i.e., pain during sexual intercourse), and excessive sexual drive. The 11th revision of the International Classification of Diseases (ICD-11), released for a first preview in June 2018 and expected to come into effect in the beginning of 2022 (World Health Organization, 2018), includes a major revision of the classification codes system but also some content-related revisions with regards to the categorization of sexual dysfunctions in women. First, the categories sexual aversion and lack of sexual enjoyment as well as excessive sexual drive have been removed. Second, female sexual arousal dysfunction includes both physiological and subjective aspects of sexual arousal (in contrast to the previous edition, which

only included physiological aspects). Third, sexual pain disorders are classified as its own category separate from sexual dysfunctions, and consists of sexual pain-penetration disorder that includes both aspects of vaginismus and nonorganic dyspareunia.

In the scientific literature, different non-diagnostic measures with various categorizations of sexual function and sexual dysfunction have been developed parallel with diagnostic manuals. The most commonly used instrument for assessing sexual function in women is the Female Sexual Function Index (FSFI; Rosen et al., 2000) self-report questionnaire. The FSFI assesses six subdomains of sexual function over the past four weeks: sexual desire, sexual arousal, lubrication, orgasm function, sexual satisfaction, and intercourse-related pain.[1]

1.2 Sexual desire

Sexual desire has often been described as a motivational state and an interest in sexual activities and experiences. However, the conceptualization of sexual desire differs somewhat across the scientific literature and when asking women for their own definitions (Brotto, 2010; Brotto, Heiman, & Tolman, 2009; Mitchell, Wellings, & Graham, 2014). Levine (2002), for instance, defined sexual desire as the "*sum of the forces that incline us toward and away from sexual behavior*" (p. 39), suggesting that motivation to engage in behavior is at the core of sexual desire. In the FSFI, again, sexual desire or interest is referred to as a "*feeling that includes wanting to have a sexual experience, feeling receptive to a partner's sexual initiation, and thinking or fantasizing about having sex*" (Rosen et al., 2000). The inclusion of sexual fantasies in the conceptualization of sexual desire can also be seen in the diagnostic criteria for sexual desire disorders. It seems, however, that many women do not spontaneously conceptualize sexual fantasies as sexual desire, but rather as an explicit way of boosting sexual desire (Brotto et al., 2009). Many women also seem to find it difficult to distinguish between sexual desire and sexual arousal (Brotto et al., 2009; Mitchell et al., 2014), with research suggesting that sexual desire and arousal are usually labeled as separate concepts, but that they often overlap both on a theoretical (Bancroft, 2005) an phenomenological level (Laan & Both, 2008; Prause, Janssen, & Hetrick, 2007). Commonly, however, sexual desire is defined as a motivational state and interest in sexual behaviors, whereas sexual arousal is defined as the subjective experience of a physiological sexual response (Brotto, 2010).

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[1] The FSFI was used in the present group of studies, and is described at length in the Measures section

Sexual desire can further be understood within the empirically supported framework of the incentive motivation model (Toates, 2009). With regards to sexual desire, the theory postulates that sexual desire is always triggered by external sexual stimuli, and that factors such as hormones, cognitive processes such as attention and previous memories of the stimuli, as well as biologically based predispositions can then influence the reaction to the stimuli. In other words, the incentive theory suggests that sexual desire is always responsive (in contrast to being spontaneous or "intrinsic"). This conceptualization is also reflected in the scientific literature on the female sexual response as a shift from spontaneous to responsive desire (Basson, 2000).

1.3 Low sexual desire, desire difficulties and disorders

Low sexual desire refers to lower levels of sexual desire and in some cases a complete lack of sexual desire. Sexual desire difficulties commonly refer to low sexual desire presenting together with feelings of distress. It should be noted, that low sexual desire is not synonymous with sexual desire difficulties, as low sexual desire *per se* does not indicate whether the individual experiences the level of desire as problematic. Sexual desire difficulties, again, are not automatically synonymous with the previously mentioned psychiatric diagnoses related to low sexual desire (i.e., FSIAD in the DSM-5, American Psychiatric Association, 2013; and HSDD in the ICD-10, World Health Organization, 2016), as sexual desire difficulties per se does not indicate whether the condition is considered pathological. For instance, in addition to having to present together with feelings of distress, both the diagnosis of FSIAD and HSDD require the low sexual desire to have persisted for at least six months, and to not be better explained by another condition. To meet diagnostic criteria for FSIAD, three of the following criteria are required: absent or reduced 1) interest in sexual activity, 2) sexual thoughts or fantasies, 3) initiation and receptivity of sexual activity, 4) sexual excitement or pleasure, 5) desire triggered by stimuli, and 6) genital or non-genital sensations (American Psychiatric Association, 2013).

It is also worth noting that the aforementioned conditions are not synonymous with asexuality, which is usually and broadly defined as a lack of sexual attraction, and which has been suggested to better fit the categorization of a sexual orientation (Brotto & Yule, 2017). In contrast to sexual desire difficulties and disorders, asexuality is commonly egosyntonic (i.e., congruent with one's values and ideal self-image), and self-identification is sufficient for using the label. Furthermore, feelings of distress, when present among asexual individuals, are not related to the asexuality itself. However, there seem to be many behavioral similarities between

asexual women and women with a lifelong sexual desire disorder, and the exact boundaries between these groups are still unclear (Brotto, Yule, & Gorzalka, 2015).

In the present group of studies, Studies I–II focused primarily on (low) sexual desire as general concept, not as a sexual difficulty or a diagnosed dysfunction. However, in Study III, the participants had to meet the DSM-5 diagnostic criteria for FSIAD to take part in the study.

1.3.1 Prevalence estimates

Research has consistently shown that the prevalence of low sexual desire in women is high, although estimates vary considerably across studies. This is, at least in part, due to methodological differences such as the use of different measurement tools, variation due to study populations (e.g., specific clinical subgroups or population-based samples), and different definitions of low sexual desire. In a recent meta-analysis, the prevalence rate for low sexual desire in premenopausal women was estimated to be 28% (McCool et al., 2016). It is worth noting that this estimate refers to low sexual desire, not desire difficulties or disorders. In fact, only 10 of the 95 included studies assessed sexual distress, making it likely that the prevalence rates for sexual desire difficulties and disorders are lower.

Indeed, studies taking sexual distress into account report prevalence estimates of 25–50% of that reported when not accounting for sexual distress (e.g., 7% vs. 21% in Burri & Spector, 2011; 10% vs. 39% in Shifren et al., 2008; 23% vs. 55% in Witting, 2008). Even when accounting for sexual distress, the prevalence rate for desire difficulties is fairly high in the general population, and it is often reported as the most common sexual complaint among women (Burri & Spector, 2011; Shifren et al., 2008; Witting, 2008), warranting the study of factors contributing to low sexual desire, as well as different treatment alternatives for desire difficulties in women.

1.4 Correlates of sexual desire

Many factors are thought to contribute to women's experienced levels of sexual desire (Khajehei et al., 2015). However, the exact nature and progression of low sexual desire is still poorly understood. For instance, most studies on factors contributing to low sexual desire have been cross-sectional, making it difficult to establish causality. In the next paragraphs, different factors that have been associated (negatively or positively) with sexual desire are presented. The correlates are presented thematically as biological, psychosocial, as well as interpersonal, in order to help the reader navigate the text. Note, however, that a strict distinction is

problematic in many cases (e.g., depression – and indeed the vast majority of all behavioral phenotypes – can be considered both physiological and psychogenic).

1.4.1 Biological correlates

First, twin studies suggest a heritable component for sexual desire, with 21–35% of the variance in levels of sexual desire being explained by additive genetic effects (Burri, Greven, Leupin, Spector, & Rahman, 2012; Witting et al., 2009). A couple of candidate gene studies have suggested associations between sexual desire and genetic variants related to dopamine (Ben-Zion et al., 2006) and estrogen (Gunst et al., 2015), although these results have not been replicated in genome-wide association studies (Burri, Hysi, Clop, Rahman, & Spector, 2012). It is also worth noting that a heritable component can be expected in virtually all psychologically relevant traits (Plomin, DeFries, Knopik, & Neiderhiser, 2016), and that the majority of the variance in levels of sexual desire seems to be explained by non-genetic factors.

Sexual desire has also been linked to a variety of substances and hormones. For instance, androgens have been indirectly associated with sexual desire, with studies reporting increased sexual desire in surgically menopausal women receiving hormone replacement therapy (Buster et al., 2005; Simon et al., 2005). However, population-based studies on serum levels of testosterone in both pre- and postmenopausal women have failed to find a clear association with sexual desire, suggesting that a possible association between sexual desire and androgens is likely complex (Davis, Davison, Donath, & Bell, 2005). Moreover, a more recent systematic review on testosterone and sexual desire in premenopausal women did not find a clear link between serum testosterone levels and sexual desire in premenopausal women (Reed, Nemer, & Carr, 2016). Some studies have reported increased sexual activity and sexual desire around the time of ovulation, although the results are somewhat inconsistent across the literature (see e.g., Brown, Calibuso, & Roedl, 2011). Hormonal contraceptives have also been linked to both decreased and increased sexual desire, although more recent review studies suggest that this association is only present in a small percentage of users, with the majority of users being unaffected (Burrows, Basha, & Goldstein, 2012; Pastor, Holla, & Chmel, 2013). Moreover, various medications such as selective serotonin reuptake inhibitors have also been linked to low sexual desire (Clayton, Kornstein, Prakash, Mallinckrodt, & Wohlreich, 2007). Acute alcohol consumption has further been positively associated with willingness to engage in sexual activity, although it has been argued that this association could at least partly be due to third variables such as, for instance, sensation-seeking (George & Stoner, 2000).

Low sexual desire has further been associated with lower overall physical health (American Psychiatric Association, 2013) and various medical conditions. Such medical conditions are, for instance, breast cancer (Abdo, Valadares, Oliveira, Scanavino, & Afif-Abdo, 2010), sexually transmitted diseases (Laumann, Paik, & Rosen, 1999), multiple sclerosis (Zivadinov et al., 1999), chronic kidney disease (Finkelstein, Shirani, Wuerth, & Finkelstein, 2007), thyroid problems, arthritis, irritable bowel syndrome, and urinary incontinence (Shifren et al., 2008). The association between some medical conditions and sexual desire could possibly be mediated through factors such as depressive symptoms, stress, and fatigue (Finkelstein et al., 2007; Zivadinov et al., 1999).

Sexual desire appears to decline with age in women. However, sexuality-related distress appears to remain stable or even decrease, which could explain why estimates of sexual dysfunction change little with age (Hayes & Dennerstein, 2005). Some studies do, however, report a higher prevalence of low and distressing sexual desire among older women (Abdo et al., 2010; Shifren et al., 2008). In general, previous literature indicates that women's sexual desire is a fluctuating and changeable trait (e.g., Leiblum, 2002; Levine, 2002), corroborated by studies demonstrating short-term fluctuations related to the menstrual cycle (Brown et al., 2011) and changes in sexual function during menopause (Burri, Hilpert, & Spector, 2015; Hayes & Dennerstein, 2005).

1.4.2 Psychosocial correlates

Lower sexual desire has also been associated with various psychological and social factors. Such factors are, for instance, stress and emotional problems (Laumann, Paik, & Rosen, 1999), negative and catastrophizing thoughts during sex (Carvalho & Nobre, 2010), symptoms of anxiety and depression (Laumann et al., 2004; Trudel, Landry, & Larosse, 1997; Shifren et al., 2008), body image issues (Woertman & Van Den Brink, 2012), more restricted sexual attitudes (Ostovich & Sabini, 2004), as well as a lower education level and inadequate information about sex during childhood (Abdo et al., 2010). Low sexual desire has also been associated with pregnancy and childbirth: In a systematic review, Yeniel and Petri (2014) noted decreasing levels of sexual desire as pregnancy progressed followed by a gradual increase in sexual desire within six months of delivery. The authors noted that the association with pregnancy and childbirth could, at least partly, be mediated through factors such as fatigue and body image issues.

1.4.3 Interpersonal correlates

A growing body of literature also suggests that partner- and relationship-related factors are associated with sexual desire. First, relationship status (i.e., whether the individual has a relationship or not) has been associated with sexual desire. Being married or in a stable relationship has been reported as a predictor of low sexual desire, when compared to single women (Abdo et al., 2010; Mansfield, Voda, & Koch, 1995; McCabe & Goldhammer, 2012; Shifren et al., 2008,). However, having no sexual partner (Køster & Garde, 1993; Shifren et al., 2008) has also been associated with lower sexual desire. Having a new partner, on the other hand, has been associated with higher levels of sexual desire (Dennerstein, Smith, Morse, & Burger, 1994).

Factors within the relationship that have been associated with lower sexual desire are, for instance, sexual incompatibility (i.e., not matching with regards to sexual preferences; Witting, Santtila, Varjonen, et al., 2008), sexual problems and dysfunctions experienced by the partner (Fugl-Meyer & Fugl-Meyer, 2002, McCabe & Goldhammer, 2012), lack of confiding in the relationship (Hällström & Samuelsson, 1990), and lower expectations about the future of the relationship (Laumann et al., 2004). In one of the few published longitudinal studies on predictors of low sexual desire, conducted among women during menopausal transition, the authors found more negative feelings for the partner to be a predictor of low sexual desire (Dennerstein, Lehert, Burger, & Dudley, 1999). In another recent study, assessing the relationship between sexual desire, relationship quality and sexual activity through the use of daily diaries, the authors found that higher relationship quality ratings among women predicted higher levels of sexual desire the following day (Dewitte & Mayer, 2018). Moreover, higher levels of sexual desire among the women themselves as well as their partners predicted higher levels of sexual desire for the women the following day.

Finally, and importantly, low sexual desire is often associated with various negative personal and interpersonal factors such as experiencing distress (Witting, Santtila, Varjonen, et al., 2008), lower personal wellbeing (Laumann, Paik, & Rosen, 1999), and lower relationship satisfaction (Witting, Santtila, Alanko, et al., 2008), thus highlighting the importance of developing efficient treatment interventions.

1.5 Associations between sexual desire and other sexual functions

Sexual desire has been associated with other sexual function domains in several studies. For instance, using data from the same population-based sample as partly used in the present group of studies (Studies I–II), Witting, Santtila, Jern, et al.

(2008) found that the levels of sexual desire correlated moderately with other sexual function domains (r = .31–.62). At least two longitudinal studies have focused specifically on investigating possible causal relationships between different sexual function domains in women. In the first of these, Burri et al. (2015) examined sexual function over a time span of four years in a population-based sample of 241 pre- and postmenopausal women. The authors reported that sexual desire predicted future levels of sexual satisfaction and lubrication, and that arousal predicted future levels of sexual desire. In a subsequent study, Pakpour, Yekaninejad, Pallich, and Burri (2015) used ecological momentary assessment (a technique employing repeated real-time sampling of participants' behaviors or experiences in ecologically valid settings, Shiffman, Stone, & Hufford, 2008) to assess cross-domain effects for specific sexual functions over six weeks in a convenience sample of 206 women. The authors included orgasm function and sexual satisfaction as predictors, and found significant associations between these and all other FSFI domains. Finally, Dennerstein et al. (1999), when studying predictors of low sexual desire in menopausal women longitudinally, reported that vaginal dryness and dyspareunia had a negative effect on sexual desire. In summary, there are some reports of cross-lagged effects between sexual desire and other sexual function, although the published studies present with some limitations: fairly small sample sizes as well as being limited to peri- and postmenopausal women (Burri et al., 2015; Dennerstein et al., 1999), and an incomplete design of included predictors (Pakpour et al., 2015).

1.6 Symptom networks for sexual desire

Although several studies have studied correlates of low sexual desire, little is known about the likely complex paths that lead to low sexual desire. Lately, a conceptual and statistical framework based on network theory has become popular in psychopathology research (Borsboom, 2017; Cramer, Waldorp, van der Maas, & Borsboom, 2010a). This framework suggests that mental disorders emerge through interactions between individual "symptoms". In other words, instead of assuming that symptoms (e.g., being tired, feeling hopeless) are a result of an underlying common cause (e.g., depression), the symptom network approach focuses on how individual symptoms are associated with each other. According to network theory, sexual desire disorder could be regarded as an activated and self-sustaining network of connected symptoms. For instance, in a hypothetical scenario, when receiving a denigrating comment about one's appearance, this could affect one's body image negatively, which could in turn cause sexual distress, which could cause a decrease in sexual arousal, which could affect sexual desire negative, which could further exacerbate sexual distress. In this scenario, the symptoms continue to affect

each other in negative loops, resulting in a pathological state where the activated network is self-sustaining (i.e., sexual desire disorder).

One advantage of emphasizing on individual symptoms and their role in the nature and progression of disorders, which is at the core of network theory, is that it resembles how psychopathology is diagnosed and conceptualized in clinical practice (Kim & Ahn, 2002). The network approach can help to empirically identify central symptoms (i.e., symptoms that have strong and/or many associations with other symptoms, and are thus assumed to easily affect or be affected by other symptoms; Borsboom, 2017). The network approach also explains phenomena such as individual differences in disorder vulnerability: individuals might differ in how vulnerable they are to developing psychopathology due to differences in how strongly symptoms are associated (Borsboom, 2017). For instance, a negative remark about one's appearance could affect sexual desire negatively for some individuals (i.e., strong associations between symptoms), whereas for some individuals, a single negative remark would not be sufficient to trigger low sexual desire (i.e., weak associations between symptoms). Further, comorbidity between diagnostically different disorders is within the network framework explained as a natural consequence of symptoms being shared between disorders, acting as bridges between disorders (Cramer, Waldorp, van der Maas, & Borsboom, 2010b). This conceptualization might be useful for understanding female sexual dysfunctions, since comorbidity between diagnostically different dysfunctions such as low sexual desire and orgasm difficulties is common (Witting et al., 2009).

1.7 Evidence-based treatments for sexual desire disorders

In the next paragraphs, evidence-based pharmacological and psychotherapeutic treatment alternatives for sexual desire disorders in women are presented.

1.7.1 Pharmacological treatments

During the last two decades, several pharmacological treatments have been evaluated for treating sexual desire disorders in women (Brotto, 2017). Flibanserin is, to date, the only agent-approved drug for treating sexual desire disorders in premenopausal women, with approvals from the U.S. Food and Drug Administration (FDA) in 2015 (U.S. Food and Drug Administration, 2015) and Health Canada in 2018 (Health Canada, 2018). The mechanism of action for flibanserin is thought to work through increased dopamine and norepinephrine levels and decreased serotonin levels in certain areas of the brain, as has been

observed in animal studies (Stahl, Sommer, & Allers, 2011). However, flibanserin has been criticized because of insufficient evidence for its efficacy, and for causing several side effects such as dizziness, somnolence, nausea, and fatigue (Jaspers et al., 2016). Moreover, it has been reported that flibanserin has received unenthusiastic responses from patients, in part because the medication has to be taken daily and because alcohol is a contraindication (Graves, 2017). Another drug, the melanocortin receptor agonist bremelanotide, is currently being evaluated for treating low sexual desire in premenopausal women, with a deadline for the FDA to review the drug in spring 2019 (Palatin Technologies, Inc., 2018). Moreover, testosterone patches have been prescribed off-label for the treatment of low sexual desire (Brotto, 2017), with studies showing improvements in sexual desire for postmenopausal women (for a review, see Achilli et al., 2017). However, results from a review study on testosterone and sexual desire in premenopausal women did not support testosterone treatment due to limited evidence of efficacy and safety (Reed, Nemer, & Carr, 2016).

1.7.2 Psychotherapeutic treatments

Alongside efforts to develop pharmacological treatment alternatives for sexual desire disorders, a scientific interest in psychotherapeutic treatment alternatives for sexual desire disorders has been revived in recent years (Brotto, 2017). The scientific interest in psychotherapeutic approaches to sexual dysfunctions dates back to Masters and Johnson (1970), who developed a treatment program for couples with sexual dysfunctions, with an emphasis on a therapy technique called sensate focus. The sensate focus approach require partners to follow a step-by-step approach to touching each other, while being asked to pay attention to sensations they experience and to give feedback to each other – without arousal as an explicit goal. For several decades, the treatment program was considered the standard method for sex therapy. As a general treatment program for sexual dysfunctions (i.e., not limited to low sexual desire in women), Masters and Johnson (1970) reported positive outcomes when evaluating the treatment in 313 couples, with only a 5% relapse rate five years after treatment. An evaluation study of the program with a specific focus on women's low sexual desire also produced positive outcomes, with 89% of the couples completing the treatment reporting some improvement (Hawton, Catalan, & Fagg, 1991). These evaluations of the treatment program, however, present with several methodological flaws such as being uncontrolled, as well as questionable main outcomes measures such as therapist evaluations of whether the couple was able to have full sexual intercourse without difficulty (i.e., not capturing the motivation or interest for a sexual experience).

Psychological treatment studies indeed present with some inherent challenges with regards to methodology. For instance, it is often not possible to conduct experimental psychotherapeutic studies in which the researchers and participants remain blind to whether the participants are taking part in the active treatment condition or the control condition (Luborski, Barrett, Antonuccio, Shoenberger, & Stricker, 2006). Within these limitations, only a handful randomized, controlled studies of psychotherapeutic treatments for low sexual desire in women have been published to date. Frühauf, Gerger, Schmidt, Munder, and Barth (2013), conducted a meta-analysis of randomized controlled psychotherapeutic treatment studies for sexual dysfunctions published between 1980 and 2009. Among the 20 waiting-list controlled studies that were included, only three targeted women's low sexual desire: the first evaluated orgasm consistency training (Hurlbert, White, Powell, & Apt, 1993), the second evaluated emotionally focused couples therapy (MacPhee, Johnson, & Van der Veer, 1995) and the third evaluated cognitive behavioral therapy for couples delivered in group (Trudel et al., 2001). The authors of the meta-analysis reported a large combined treatment effect (Cohen's d = 0.91) for these three studies, but concluded that the methodological qualities of the studies were low. For instance, none of the three studies included sufficient reports on the statistical analyses and treatment allocation procedures, and the representativeness of the study samples was also considered poor. In a systematic review of controlled studies on psychotherapeutic treatments for female sexual dysfunctions conducted by Günzler and Berner (2012), the authors included the same three waiting-list controlled studies on sexual desire difficulties as Frühauf et al. (2013). Here, the authors suggested an inclusion of the partner in the treatment of sexual desire difficulties, based on results by Hurlbert et al. (1993) showing that women who participated in the treatment together with their partner reported higher sexual desire after treatment than did women who participated alone.

More recently, some randomized controlled intervention studies that were not included in Frühauf's et al. (2013) meta-analysis have generated promising results. These studies have generally employed a cognitive behavioral approach. For instance, Mintz, Balzer, Zhao, and Bush (2012) evaluated a six-week bibliotherapy intervention that included components of cognitive behavioral therapy and psychoeducation, and reported positive treatment effects for improving sexual desire (Cohen's d = 1.19–1.36), sexual arousal, sexual satisfaction, and total sexual function. Within the cognitive behavioral framework, there has also been a growing interest in treatments for sexual dysfunctions that include components of mindfulness. These mindfulness-based techniques usually involve exercises aiming to bring attention to the present moment (Kabat-Zinn, 2005). In the context of sexual difficulties, mindfulness-based exercises aim to encourage non-judgmental observation of negative thoughts, and redirect the attention to bodily sensations

(Stephenson & Kerth, 2017). A meta-analysis on mindfulness-based treatments for female sexual dysfunctions (Stephenson & Kerth, 2017) included two waiting-list-controlled studies that targeted women's low sexual desire. The first study (Brotto et al., 2012) evaluated a mindfulness-based intervention in women that had been treated for cervical or endometrial cancer, and reported significant treatment effects for sexual desire, sexual arousal, lubrication, orgasm function, sexual satisfaction, and sexual distress. The second study, conducted by the same research team (Brotto & Basson, 2014), evaluated a mindfulness-based group intervention in women with low sexual desire and/or arousal, and reported significant treatment effects for sexual desire (Cohen's $d = 0.56$ when including all treated participants), sexual arousal, lubrication, sexual satisfaction, and total sexual function – but not for sexual distress, for instance, which is a key component of sexual desire disorders. Lastly, some psychotherapeutic treatment studies have approached treatment from a mixed sexual problems perspective. In a waiting-list controlled study, Hucker and McCabe (2015) evaluated a multimodal online intervention for women experiencing difficulties with sexual desire, arousal, orgasm and/or pain. The intervention included cognitive, behavioral, and mindfulness-based components. Among the participants, 96% experienced problems related to low sexual desire before treatment, and the treatment effect for sexual desire was reported at $\eta^2 = 0.11$ and for sexual distress at $\eta^2 = 0.38$ (interpreted as medium and large; Cohen, 1988).

In summary, psychotherapeutic treatment for women's sexual desire disorders seem promising, but there are only a few controlled studies published to this day, and these studies present with variable methodological qualities, evaluated contents, and reports on treatment effects for sexual desire and secondary outcomes. Considering this, further efforts in evaluating psychological treatments for sexual desire disorders in women are warranted.

2 Aims

The overarching aims of the present thesis were to 1) improve the understanding of the change over time in sexual desire and predictors of low sexual desire in women, and 2) evaluate psychological treatment interventions for sexual desire disorders in women. To achieve the first aim, two different statistical models were employed in large-scale population-based longitudinal survey data provided by Finnish women. To achieve the second aim, two psychological intervention conditions were evaluated in a clinical sample of women fulfilling the criteria for FSIAD. Specific hypotheses were formulated in the two latter studies, whereas the first study had a more explorative research questions.

2.1 Aims of Study I

In the first study, we fitted a cross-lagged structural equation model to a large, population-based, longitudinal data set with two measurement points collected seven years apart. By doing so, we wanted to investigate the following research questions:

RQ1.   (How much) does the group mean level of sexual desire change between the two time points seven years apart?

RQ2.   How much of the variance in the level of sexual desire at the second time point can be explained by the level of sexual desire at the first time point? We were, in other words, interested in the temporal stability of sexual desire over long time.

RQ3.   Do other domains of sexual function affect sexual desire over time, and vice versa, does sexual desire affect other domains of sexual function over time? We were, in other words, interested in identifying causal relationships[2] between sexual desire and other domains of sexual function.

RQ4.   Do temporal mean change (RQ1), temporal stability (RQ2) and cross-

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[2] With longitudinal data, causality can at best be established at Granger level (Granger, 1969).

domain causal effects (RQ3) depend on the relationship status of the women?

2.2 Aims of Study II

In the second study, we fitted cross-sectional group-level symptom network models to the same data set as in Study I. By doing so, we wanted to investigate the following research questions:

RQ5.   Are there any differences in symptom network structure between groups of women whose level of sexual desire decreased, increased, or remained stable between the two time points? We were, in other words, interested in whether factors previously associated with sexual desire could help to explain changes in sexual desire over time. Network structures were compared at the first time point in terms of *connectivity* (i.e., the pattern and strength of associations between individual symptoms in the network), *centrality* (i.e., the number and strength of associations an individual symptom has with other symptoms in the network), and *clustering* (i.e., subgroups of symptoms in the network that are more strongly connected).

RQ6.   Are there any network structure patterns relevant to sexual desire that are present in all three groups?

RQ7.   Would any network differences (RQ5) and similarities (RQ6) observed at the first time point replicate when estimating the networks in the same groups of women at the second time point?

Based on previous literature, we hypothesized that:

H1.   Women with decreases in sexual desire between the two time points would show stronger positive connections among "negative" variables (e.g., sexual distress and intercourse-related pain) at the first time point compared to the other two groups.

H2.   Women with increases in sexual desire between the two time points would show stronger positive connections among "positive" variables (e.g., sexual satisfaction and orgasm function) at the first time point, compared to the other two groups.

H3.   Women with decreases in desire would show stronger negative connections between "negative" and "positive" variables (e.g., sexual distress and orgasm function), compared to the other two groups.

2.3 Aims of Study III

In the third study, we evaluated two brief, mindfulness-based psychological treatment conditions in a clinical sample of women fulfilling the criteria for FSIAD. In the first treatment condition, participants were administered an individually delivered version of Brotto and Basson's (2014) group treatment protocol. In the second treatment condition, participants were administered additional exercises with an emphasis on scheduling sex as well as the woman's own motivations for engaging in sex. The two treatment conditions were further compared to a waiting list control condition. By doing so, we wanted to investigate the following research questions:

RQ8. Would the two treatment conditions have an effect on sexual desire and secondary outcomes such as sexual distress, other sexual functions, relationship satisfaction, and psychological distress? Here, the first treatment condition served two purposes: adding to the literature of the treatment protocol, and serving as an active comparison group in RQ9.

RQ9. Would the exercises with an emphasis on scheduled sex and motivations for engaging in sex have any additional treatment benefits (e.g., make treatment more effective)?

Based on previous literature, we hypothesized that:

H4. Women in both treatment conditions would have improvements in sexual desire, compared to women in the waiting list control condition.

H5. Women in the condition focusing on scheduled sex and motivations for engaging in sex would have greater improvements in sexual desire than the condition following Brotto and Basson's treatment protocol alone, as the new component highlighted creating and strengthening situations with sexual triggers, which could facilitate responsive desire.

H6. Women in both treatment conditions would have improvements in secondary outcomes compared to women in the waiting list control condition.

3 Methods

A summarizing overview of the study queries, samples, measures, and statistical methods are provided in Table 1.

Table 1. Overview of study queries, samples, measures, and statistical methods of the original studies

Study	Queries	Samples	Measures	Methods
I	Studying the temporal stability and cross-domain effects of sexual function	GSA N = 2,173	FSFI, relationship status	SEM
II	Comparing symptom networks for women with decreased, increased, and stable levels of sexual desire	GSA N = 1,449	FSFI, FSDS, SDI-2, BSI-18, DSFI-BI, AUDIT, DASA, SOI, relationship status, hormonal contraceptive use, weight, height, biological children	Network analysis
III	Evaluating two psychological treatment conditions for sexual desire disorder	Clinical N = 70	FSFI, SIDI-F, FSDS-R, RDAS, PRQC, BSI-18, STTS-R	ANCOVA, within- and between-group t tests

Note. GSA = The Genetics of Sexuality and Aggression data set, FSFI = The Female Sexual Function Index, FSDS = The Female Sexual Distress Scale short form, SDI-2 = The Sexual Desire Inventory-2 short form, BSI-18 = The Brief Symptom Inventory-18 anxiety and depression subscales, DSFI-BI = The Derogatis Sexual Function Inventory body image subscale, AUDIT = The Alcohol Use Disorders Identification Test, DASA = The Desired and Actual Sexual Activity Scale, SOI = The Sociosexual Orientation Inventory, SIDI-F = The Sexual Interest and Desire Inventory Female, FSDS-R = The Female Sexual Distress Scale-Revised, RDAS = The Revised Dyadic Adjustment Scale, PRQC = The Perceived Relationship Quality Components Inventory short form, STTS-R = The Satisfaction With Therapy and Therapist Scale-Revised, SEM = Structural equation modeling, ANCOVA = Analysis of covariance

3.1 Participants

The participants in the present group of studies originated from two separate survey data collections: the population-based Genetics of Sexuality and Aggression collection (Johansson et al., 2013), and a clinical data collection involving women seeking treatment for low sexual desire.

3.1.1 The population-based sample (Studies I–II)

The Genetics of Sexuality and Aggression (GSA) data collection is a large-scale, Finnish, population-based study conducted in 2006 (T1) and again in 2013 (T2). The original data collection was carried out in 2006 and targeted all twins aged 18–33 years and their over 18-year-old siblings living in Finland at the time (Johansson et al., 2013). All participants in the data collection were identified from the Finnish Central Population Registry. A total of 7,680 female twins and 3,983 sisters were contacted by mail and asked if they were interested in completing a sexuality-related questionnaire. A total of 6,200 women completed the questionnaire either by mail or online through a secure web page, resulting in a response rate of 53.2%. In 2013, women in the first data collection who had declared an interest in participating in future studies were contacted again by mail and asked if they were interested in participating in a follow-up study. Of these 5,197 women, 2,173 participated by completing an online questionnaire through a secure web page resulting in a response rate of 41.8%. These 2,173 women, with responses from both T1 and T2 (M_{age} = 25.5 years, SD = 5.0), constituted the sample of Study I. In Study II, the study design required the participants to be genetically unrelated and to have responses on the categorical variable relationship status. Further, the subsamples compared in Study II were required to be equally sized. These exclusion criteria lead to the removal of 724 participants and resulted in a final sample size of 1,449 women.

An ethical research permit was obtained for both data collections from the Ethics Committee of Åbo Akademi University, in accordance with the Helsinki Declaration. The purpose of the study was clearly described and the voluntary and anonymous nature of the participation emphasized. Written informed consent was obtained from all participants at both time points.

3.1.2 The clinical sample (Study III)

The clinical data consisted of survey responses from 70 women (M_{age} 39.2 years, SD = 9.8) with complaints of low sexual desire. These women participated in a multicenter treatment study involving ANOVA, Karolinska University Hospital in Stockholm, Sweden (in 2016–2017) and Åbo Akademi University in Turku, Finland (in 2016). To participate in the study, the participants had to fulfill the DSM-5 criteria for FSIAD (American Psychiatric Association, 2013), be at least 18

years old, in a relationship, Swedish speaking, and willing to attend four individual sessions in central Stockholm (or Turku). Exclusion criteria included use of selective serotonin reuptake inhibitors, hormone replacement therapy, self-reported psychiatric diagnoses, concurrent psychological treatment elsewhere, significant relationship problems (e.g., one or both partners lacked motivation to continue their relationship, ongoing severe conflict in the relationship relating to something other than sexual difficulties), and frequent dyspareunia during sexual intercourse not relieved by the use of a personal lubricant. Women with orgasm problems were included provided this was not the primary sexual complaint. All assessments as well as intervention sessions were carried out by the same licensed psychologist (the author) with specific training in female sexual dysfunctions and mindfulness for sex and intimate relationships.

Participants in Stockholm were recruited during the fall of 2016 through an advertisement in a local newspaper distributed to households in Metropolitan Stockholm, a Google advertisement visible in Metropolitan Stockholm, and through referrals at the clinic's regular practice. Interested women were instructed to complete a screening survey through a secure online service. The 136 women who completed the screening survey were contacted by telephone and/or e-mail. Of these, 12 did not reply and 16 declined to participate. Of the interested women, 35 were excluded because they did not fulfill inclusion criteria and/or fulfilled one or several exclusion criteria. This was based either on their survey responses, or a subsequent detailed screening at the beginning of the first treatment session. Seven of the preliminary interested participants were not included due to time issues. Excluded women were referred to other clinics in Stockholm. In addition to the participants in Stockholm, 4 Swedish-speaking participants who underwent the treatment intervention in Turku, Finland, during spring 2016, were also included in the analyses. Participants in Turku were recruited trough an advertisement in a local newspaper, posters at universities and hospitals in Turku, as well as advertisements on social media such as Facebook. Inclusion and exclusion, randomization, session design, intervention content, facilitator, data collection, and informed consent corresponded to that in Stockholm, with some exceptions (i.e., some measures were not included in data collection and there was no six month follow-up). Thus, the final sample of included participants consisted of 70 women.

Informed consent was collected from all participants at the beginning of the first session in accordance with the Helsinki declaration. Participants were informed that participation was completely voluntary and that they could discontinue their participation at any time, without giving a reason for doing so. Upon request, data already collected would be deleted at discontinuation. No reimbursements were given to the participants. However, the treatment sessions were free of charge. The study was approved by the Regional Ethical Review Board in Stockholm as well as the Ethics Committee of Åbo Akademi University in Turku.

3.2 Treatment intervention content (Study III)

The participants were randomly allocated to one of three conditions: 1) a mindfulness-based treatment condition (MB; $n = 20$), 2) a treatment condition with exercises focusing on scheduled sex and motivations for engaging in sex (SS; $n = 30$), and 3) a waiting list condition ($n = 20$). Both active treatment conditions included four individual sessions at the clinic and home exercises. The MB condition followed a translated version of the multimodal treatment protocol used in Brotto and Basson (2014). The protocol consisted of psychoeducation, components of cognitive therapy and mindfulness exercises, as well as various practical exercises related to, for instance, body image and the relationship. In contrast to Brotto and Basson (2014), who delivered the protocol in a group setting, the protocol was delivered in an individual setting in our study. The SS condition followed the same protocol as the MB condition, with additional exercises including scheduled sex and the women's own motives for engaging in sex. The scheduled sex exercises encouraged the woman to schedule sex with her partner between the sessions. Mutual consent was emphasized. The exercises focusing on own motives focused on highlighting the woman's own motives for engaging in sex. The exercises emphasized the variety of possible reasons for engaging in sex other than spontaneous desire, and the participants were instructed to focus on subjectively held important motives and communicating motives and sexual preferences to the partner.

3.3 Measures

Self-report questionnaires used in the present group of studies are described below. An overview of the questionnaires, including internal consistencies, is presented in Table 2.

Table 2. Overview of questionnaires included in the present group of studies

Trait	Instrument	Studies	Subdomains	Chronbach's α
Sexual function	The Female Sexual Function Index (FSFI)	I–III	Desire Arousal Lubrication Orgasm Satisfaction Pain[b] Total	.78[GSA]; .74[C] .86[GSA]; .97[C] .87[GSA]; .98[C] .89[GSA]; .97[C] .81[GSA]; .74[C] .80[GSA]; .98[C] .96[C]

	The Sexual Interest and Desire Inventory Female (SIDI-F)	III	Total	.80[C]
	The Sexual Desire Inventory-2 (SDI-2; short form)	II	Total	.79[GSA]
Sexual distress	The Female Sexual Distress Scale-Revised (FSDS-R)[c]	II, III	Total	.89[GSA]; .93[C]
Anxiety and depression	The Brief Symptom Inventory-18 (BSI-18)	II, III	Anxiety Depression	.85[GSA]; .83[C] .84[GSA]; .69[C]
Body dissatisfaction	The Derogatis Sexual Function Inventory (DSFI; 11 items from the body image subdomain)	II	Total	.70[GSA]
Alcohol use	The Alcohol Use Disorders Identification Test (AUDIT)	II	Total	.81[GSA]
Desired and actual sexual activity	Desired and Actual Sexual Activity Scale (DASA)	II	Actual Desired	.58[GSA] .69[GSA]
Sociosexual orientation	The Sociosexual Orientation Inventory (SOI)	II	Total	.52[GSA]
Relationship satisfaction	The Revised Dyadic Adjustment Scale (RDAS)	III	Total	.82[C]
	The Perceived Relationship Quality Components Inventory (PRQC; short form)	III	Total	.87[C]
Treatment satisfaction	Satisfaction With Therapy and Therapist Scale-Revised (STTS-R)	III	Therapy Therapist	.80[C] .76[C]

Note. GSA = The Genetics of Sexuality and Aggression data set (Studies I–II) at the first measurement point in 2006 (*n:*s varied between 1,580 and 2,132 depending on subscale), C = Clinical sample (Study III), first measurement point of each individual (*n:*s varied between 47 and 70 depending on subscale). Subdomains used in the present group of studies are reported.
[b] One item (no. 18) from the original instrument was not included in the GSA data collection in 2013. Consequently, the pain domain in Studies I–II consisted of two items (no. 17 and 19) instead of three.
[c] A short form including seven items was used in the GSA.

3.3.1 Sexual desire and other sexual functions

In Studies I–III, sexual desire and other sexual functions were assessed with the Female Sexual Function Index (FSFI; Rosen et al., 2000). Sexual desire was additionally assessed with the Sexual Interest and Desire Inventory Female (SIDI-F, Clayton et al., 2006) in Study III, and with a short form of the Sexual Desire Inventory-2 (SDI-2, Spector, Carey, & Steinberg, 1996) in Study II.

The FSFI was developed to assess sexual function in women over the past four weeks (Rosen et al., 2000). The FSFI consists of 19 Likert-type items divided into six subdomains: sexual desire (items 1–2), sexual arousal (items 3–6), lubrication (items 7–10), orgasm function (items 11–13), sexual satisfaction (items 14–16), and intercourse-related pain (items 17–19). Sexual desire is here defined as wanting to have a sexual experience, being receptive to sex, as well as having sexual thoughts or fantasies. The items in the FSFI are scored from 1 to 5 for some of the items with higher scores indicating higher sexual function, and from 0 to 5 for some of the items with the supplementary 0 response "*no sexual activity / did not attempt intercourse*". We added the response option "*no partnered activity*" to items 14 and 15, which analogous with the response options of other items was given the value of 0. Due to a technical error, item 18 from the subdomain assessing pain was left out from the second measurement point of the GSA data collection. Therefore, the remaining two items 17 and 19 were used to form the pain domain in Studies I–II. The FSFI has been criticized for treating the no sexual activity response as the low point of each item's response scale (Meyer- Bahlburg & Dolezal, 2007). In Study I, we employed a conservative approach to address this potential confounder by treating zero responses as missing values. In Studies II-III, we chose to use the original version of the scale in order to retain statistical power for the treatment study and network analyses.

The psychometric properties of the FSFI have been evaluated in different clinical samples, with the questionnaire demonstrating adequate internal consistency (i.e., associations between individual items in each subdomain; Meston, 2003; Rosen et al., 2000), test-retest reliability (i.e., stability of responses over time; Rosen et al., 2000), convergent validity (i.e., associations with results obtained with other measures aimed to assess the same construct; Baser, Li, & Carter, 2012), divergent validity (i.e., associations with related constructs such as relationship satisfaction; Meston, 2003, Rosen et al., 2000), and discriminant validity (i.e., differentiation between dysfunctional and non-dysfunctional women; Wiegel, Meston, & Rosen, 2005; Rosen et al., 2000). Moreover, Witting, Santtila, Jern, et al. (2008) demonstrated adequate divergent validity and high internal consistencies for the subdomains when evaluating the psychometric properties of the FSFI in the population-based GSA data used in Studies I–II. The authors chose a six-factor

solution over a five-factor solution based on clinical considerations (i.e., separating between the domains desire and arousal), in line with previous clinical validation studies (e.g., Rosen et al., 2000). In the present groups of studies, the internal consistencies of the FSFI subdomains ranged from acceptable to excellent (see Table 2).

Whereas the FSFI was developed as a general measure of sexual function in women, The SIDI-F (Clayton et al., 2006) was developed to assess the severity of symptoms in women diagnosed with hypoactive sexual desire disorder (HSDD; i.e., the former DSM diagnosis of low sexual desire in women; American Psychiatric Association, 2000). The SIDI-F consists of 13 Likert-type items (total score range 0–51, higher scores indicating higher levels of sexual desire) as well as an additional non-scored item assessing intercourse frequency. The SIDI-F includes aspects such as receptivity to sex, initiation of sex, frequency and strength of desire for sex and physical affection, satisfaction with desire, distress related to desire, responsive desire, as well as items focusing on arousal and orgasm function. The SIDI-F has initially demonstrated adequate internal consistency, convergent validity, divergent validity, and discriminant validity (Clayton et al., 2006). In Study III, the SIDI-F demonstrated good internal consistency (see Table 2).

Lastly, we used a short form of the SDI-2 (Spector, Carey, & Steinberg, 1996) when creating sexual desire subgroups in Study II, as using a measure that is already included in the network (i.e., the desire subdomain of the FSFI) can lead to induced artifacts in the covariance structure (Muthén, 1989). The original SDI-2 was developed as a (gender non-specific) measure of sexual desire and includes two subdomains: solitary and dyadic sexual desire. The authors of the original scale reported adequate internal consistencies for the subscales (Spector et al., 1996), test-retest reliability and convergent validity for both subscales (as cited in Davis, Yarber, Bauserman, Schreer, & Davis, 1998) Adequate divergent validity for the dyadic subscale has also been reported with regards to relationship satisfaction, sexual satisfaction, and sexual arousal (as cited in Davis et al., 1998).

We used a short form of the SDI-2 that included six Likert-type items (3, 5, 9, 11, 13, and 14) from the original questionnaire, summed together to form a composite variable (score range 0–47, higher scores indicating higher levels of sexual desire). The short form included items from both the solitary and dyadic subdomains, thus differing from the original factor structure by assessing desire to engage in both partnered and solitary forms of sexual activity. The internal consistency of the composite variable was considered acceptable (see Table 2).

3.3.2 Sexual distress

In Study III, sexual distress was assessed using the Female Sexual Distress Scale-Revised (FSDS-R; Derogatis, Clayton, Lewis-D'Agostino, Wunderlich, & Fu, 2008). The original Female Sexual Distress Scale (FSDS; Derogatis, Rosen, Leiblum, Burnett, & Heiman, 2002) was developed to assist researchers and clinicians in assessing sexuality-related distress in women. The FSDS-R was developed to enhance the sensitivity of the original scale for women with HSDD by adding an item inquiring about distress related to low sexual desire. The FSDS-R consists of 13 Likert-type items (score range 0–52; higher scores indicating higher levels of distress) and has demonstrated good discriminant validity and test-retest reliability (Derogatis et al., 2008). In Study III, the internal consistency of the full scale was considered excellent (see Table 2). In Study II, a short-form of the FSDS-R was used, which included seven items (1, 3, 5, 8, 9, 10, and 11) from the original scale. The internal consistency of the short form was considered good (see Table 2).

3.3.3 Symptoms of anxiety and depression

In Studies II–III, symptoms of anxiety and depression were assessed using two subdomains from the Brief Symptom Inventory-18 (BSI-18, Derogatis, 2001). The BSI-18 was developed as a screening measure of psychological distress based on the Symptoms Checklist (Derogatis & Melisaratos, 1983). We used the subdomains anxiety and depression based on the factor structure suggested by Derogatis (2001), with six Likert-type items per subdomain (score range 6–30 per subdomain; higher scores indicating higher levels of anxiety/depression symptoms). The BSI-18 has previously demonstrated adequate validity in various clinical populations, for instance by being sensitive to changes in distress levels (Derogatis & Savitz, 2000). In Studies II–III, the subscales demonstrated good internal consistencies with one exception – the depression scale demonstrated a questionable internal consistency in Study III (see Table 2).

3.3.4 Relationship status

In Study I, relationship status was categorized by inquiring whether the woman was in a relationship at the second measurement point of the GSA data collection (T2; 2013) and if so, if they were in a relationship with the same partner as at the first measurement point of the GSA data collection (T1; 2006). Based on these responses, the women were divided into three different relationship status groups: those who were *single* at T2, those who were in a relationship with a *new* partner at T2 (either no partner at T1 or in a relationship with a different partner at T1), and

those who were in a relationship with the *same* partner at both time points. In Study II, relationship status in 2006 was categorized by inquiring about whether the woman was in a steady sexual relationship at the time of study (yes/no).

3.3.5 Relationship satisfaction

In Study III, relationship satisfaction was assessed using the Revised Dyadic Adjustment Scale (RDAS; Busby, Christensen, Crane, & Larson, 1995), as well as a short form of the Perceived Relationship Quality Components Inventory (PRQC; Fletcher, Simpson, & Thomas, 2000).

The RDAS assesses relationship satisfaction through proxy behaviors (i.e., behaviors that are commonly considered to reflect a desired partnered relationship – for instance, engaging in outside interests together). The RDAS was developed from the Dyadic Adjustment Scale (Spanier, 1976) and consists of 14 Likert-type items forming three subdomains (consensus, satisfaction, cohesion) as well as a total score. We used the total score to assess overall relationship satisfaction (range 0–69; higher scores indicating higher levels of relationship satisfaction). The RDAS has previously demonstrated good internal consistency for the total score (e.g., Cuenca Montesino, Graña Gómez, Peña Fernández, Andreu Rodríguez, 2013; Ward, Lundberg, Sabriskie, & Berrett, 2009) as well as good construct and criterion validity (Busby et al., 1995). In Study III, the RDAS demonstrated good internal consistency (see Table 2).

While the RDAS assesses relationship satisfaction through proxy behaviors, the PRQC assesses relationship satisfaction trough subjectively held evaluations of relationship satisfaction (e.g., self-reports on how intimate the relationship is). The original PRQC consists of 18 Likert-type items divided into six subdomains: relationship satisfaction, commitment, intimacy, trust, passion, and love (Fletcher, Simpson, & Thomas, 2000). Fletcher et al. (2000) suggested that the scale could be reduced to one item from each subdomain to assess global relationship satisfaction. We used the 6-item version of PRQC (score range 6–42; higher score indicating higher relationship satisfaction), which demonstrated good internal consistency (see Table 2).

3.3.6 Treatment satisfaction

In Study III, satisfaction with treatment was assessed using the revised version of the Satisfaction With Therapy and Therapist Scale (STTS-R; Oei & Green, 2008). The STTS-R is a revised version of the original Satisfaction With Therapy and Therapist Scale (STTS; Oei & Shuttlewood, 1999), which was developed to assess satisfaction with therapy in patients undergoing group cognitive therapy for

depression. In contrast to the original version, the STTS-R is non-specific with regards to therapy setting and type of disorder treated. The STTS-R consists of 13 Likert-type items, which are divided into two subdomains (satisfaction with therapy and satisfaction with therapist; subdomain score range 6–30, higher scores indicating higher satisfaction) as well as an outcome variable (“*How much did this treatment help with the specific problem that led you to therapy?*”). The STTS-R has previously demonstrated good internal consistency, convergent validity, and discriminant validity (Oei & Green, 2008). In Study III, the satisfaction with therapy subscale demonstrated good internal consistency, and the satisfaction with therapist subscale demonstrated acceptable internal consistency (see Table 2). Moreover, information concerning the participants' subjective experience of the usefulness of different components of the intervention was assessed on a Likert scale from 1 (*Not useful at all*) to 5 (*Very useful*).

3.3.7 Body dissatisfaction

In Study II, body dissatisfaction was assessed using eleven gender-neutral items from the body image subscale of the Derogatis Sexual Function Inventory (DSFI; Derogatis & Melisarotos, 1979), as previously done in other studies based on the GSA data (see Ålgars, 2012). The eleven Likert-type items were summed together to form a composite variable (range 11–55; higher scores indicating more body dissatisfaction). The DSFI has previously demonstrated adequate internal consistency, test-retest reliability, content validity, and discriminant validity (Daker-White, 2002). In Study II, the eleven body dissatisfaction items demonstrated acceptable internal consistency (see Table 2).

3.3.8 Alcohol use

In Study II, (hazardous) alcohol use was assessed using The Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), which was developed by the World Health Organization as a screening questionnaire for alcohol use. The AUDIT consists of ten Likert-type items (total range 0–40; higher scores indicating more frequent and hazardous alcohol use). The AUDIT is one of the most frequently used screening tools for alcohol use and related problems, and has previously demonstrated good internal consistency and test-retest reliability (Allen, Litten, Fertig, & Babor, 1997), as well as construct validity, convergent validity, and discriminant validity (Bohn, Babor, & Kranzler, 1995). In Study II, the AUDIT demonstrated good internal consistency (see Table 2).

3.3.9 Desired and actual sexual activity

In Study II, the desired and actual frequency of sexual behaviors was assessed using by creating two discrepancy scores based on the Desired and Actual Sexual Activity Scale (DASA; Santtila et al., 2007), a modified version of the drive subscale of the DSFI (Derogatis & Melisarotos, 1979). The DASA consists of 12 nine-point Likert-type items; six items inquiring about how frequently the respondent engages in specific sexual behaviors (kissing and petting, sexual fantasies, masturbation, vaginal sex, oral sex, and anal sex) and six items inquiring about how frequently the respondent desires the specific sexual behaviors. In Study II, the actual sexual activity items were subtracted from the desired sexual activity items, resulting in a discrepancy variable with a score range between −54 (indicating that the respondent had engaged in more sexual activity than she desired) and 54 (indicating that the respondent had engaged in less sexual activity than she desired). This variable was further divided into two variables: one ranging from −54 to 0 (i.e., positive values were replaced with 0) representing a variable of *too much* sexual activity, and another ranging from 0 to 54 (i.e., negative values were replaced with 0) representing a variable of *too little* sexual activity. In Study II, the desired behaviors domain and the actual behavior domain both demonstrated poor internal consistency (see Table 2), suggesting intra-individual variance with regards to responses to specific items within the domains.

3.3.10 Sociosexual orientation

In Study II, sociosexual orientation was assessed using the Sociosexual Orientation Inventory (SOI; Simpson & Gangestad, 1991). Sociosexual orientation refers to an individual's attitudes towards and tendency to engage in casual and uncommitted sexual relations. The SOI includes four nine-point Likert-type items measuring attitudes and three open ended numerical items measuring behaviors and has demonstrated adequate convergent and discriminant validity (Simpson & Gangestad, 1991). The items were summed together according to the formula in Simpson and Gangestad (1991) to form a composite variable with higher scores indicating a more liberal sexual orientation. Simpson and Gangestad (1991) noted that the attitude items demonstrated a somewhat higher internal consistency than the full scale, but chose to include the behavior items for a broader coverage of sociosexual orientation. In Study II, the composite variable demonstrated a questionable internal consistency (see Table 2), indicating that the scale is not optimal for measuring an overarching construct of sociosexual orientation. Indeed, a later revision of the scale includes separate factors for the attitudinal and behavioral items (Penke & Asendorpf, 2008). However, we chose to follow the

original instructions from the authors, noting the shortcomings of representing sociosexual orientation as one construct.

3.3.11 Other measures

Other measures included in the studies were age (Studies I–III), height and weight (Study II), use of hormonal contraception (yes/no; Study II), number of biological children (Study II), and self-perceived homework compliance (assessed on a Likert scale from 1 *"Did not follow homework instructions at all"* to 5 *"Followed homework instructions exactly as instructed"*; Study III).

3.4 Study designs and statistical analyses

Basic statistical analyses in Studies I–III such as descriptive statistics and *t* tests were conducted using IBM SPSS Statistics 22.0 (IBM Corp., 2013).

3.4.1 Structural equation modeling (Study I)

In Study I, we applied cross-lagged longitudinal structural equation models (SEM) to the FSFI in the GSA data using the software Mplus version 7.3 (Muthén & Muthén, 1998–2012). Some of the advantages of SEM are that the analyses account for measurement error through the use of latent factors (i.e., factors are inferred from directly measured variables in the model), account for the within-time covariance between factors, and allow for models with several dependent variables simultaneously.

All six subdomains of the FSFI were included both as independent factors (assessed at T1) and dependent factors (assessed at T2) in the models. Since the sample consisted of twins and siblings of twins, we controlled for familial dependence by including family identity as a clustering variable in the models. Age was further included as a covariate in all models. A simplified illustrative model is presented in Figure 1. We used the maximum-likelihood estimation with robust standard errors (MLR), as the data did not fill all the requirements for multivariate normality. We handled missing data using full information maximum likelihood, that is, all available information in the variables included was used to estimate the models (Muthén & Muthén, 1998–2012).
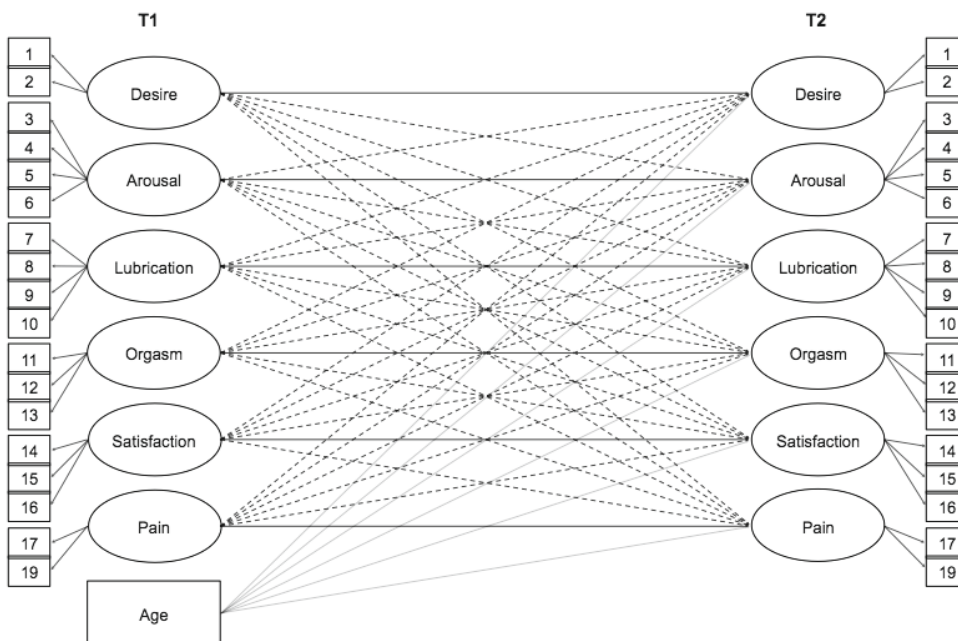
Figure 1. A simplified illustration of the cross-lagged structural equation model based on the Female Sexual Function Index (numbers represent the corresponding questionnaire item). Ellipses represent latent factors, squares represent observed variables and arrows between these represent factor loadings. In the structural part, arrows with solid lines represent temporal stabilities within the domains, and arrows with dashed lines represent cross-domain associations over time. Age and family identity (not shown) were further included in the model. Within-time correlations, measurement error, and residual variance are not shown. The figure is adapted from Gunst et al., 2017.

To test for measurement invariance between the two time points (i.e., ensuring that the FSFI domains represented the same constructs at both time points), we parameterized the models using the fixed factor method for longitudinal data (Little, 2013). Based on the measurement invariance model (supporting a strong invariance model, i.e., equality of factor loadings and intercepts across time), we created a model that estimated the relationship between the domains over time (cross-time/cross-domain paths) and the temporal stability of the domains (cross-time/within-domain paths) by freely estimating all paths. We then inspected possible causal relationships between domains found in the free model by pairwise equation of standardized paths (e.g., so that the path from sexual desire at T1 to pain at T2 and the path from pain at T1 to sexual desire at T2 were equated). We then compared the equated models with the free model using the Satorra–Bentler scaled $\chi2$ difference test for MLR (Satorra & Bentler, 2001). If equating paths

resulted in a decrease in model fit, it would indicate that the paths indeed differed from each other.

The procedure described above was then repeated in the three different relationship status groups: those in relationships with the same partner at both time points, those in relationships with a new partner at T2, and those who were single at T2. In the relationship status group analyses, relationship duration was further included as a covariate in these analyses, in order to differentiate between relationship duration and partner-specific factors (i.e., we were interested in partner-specific factors).

3.4.2 Network modeling (Study II)

In Study II, we applied cross-sectional group-level network models to the GSA data, using network packages for *R* (version 3.3.3, R Core Team, 2013). A simplified illustrative network model is presented in Figure 2.

In the main analyses, we estimated cross-sectional group-level networks at T1. Here, we compared three groups of women: a) those whose levels of sexual desire *decreased* between the two measurement points (i.e., women with scores more than −0.5 *SD* from the *M* of the change in SDI-2 between T1 and T2), b) those whose levels of sexual desire *increased* between the two measurement points (i.e., women with scores more than +0.5 *SD* from the *M*), and c) those whose sexual desire remained relatively *stable* between the two measurement points (i.e., women with scores within 0.5 *SD* from the *M*). T2 was thus used for creating the grouping variable, but the variables included in the estimated networks were based on only T1 (i.e., the networks were cross-sectional). However, we also replicated the analyses, creating cross-sectional networks based on T2.
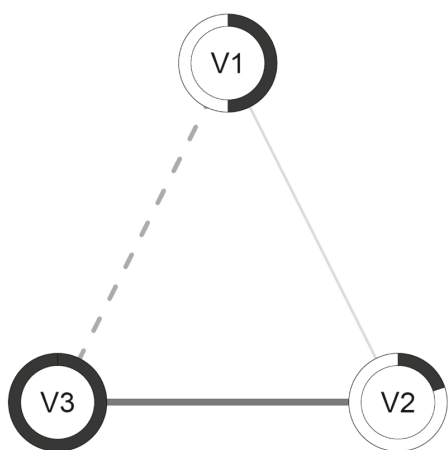
Figure 2. A simplified illustrative network model. Variables are represented by "nodes" (visualized as circles) and associations between variables are represented by "edges" (visualized as lines between nodes). In our study, edges represented partial correlations, that is, their associations with all other variables included in the network were controlled for. The "pies" around the nodes illustrate how much of the node's variance can be explained by the nodes connected to it (e.g., for V3, all of the variance is explained by V1 and V2). The figure is reprinted from Gunst, Werner et al., 2018.

First, we estimated the network models of the three groups with the *mgm* package (Haslbeck & Waldorp, 2018), which models relationships according to the distributional assumptions of the respective variables. In order to limit the likelihood of estimating false positives, we used regularization and EBIC-model selection (i.e., the software estimates several models with differing levels of sparsity and chooses the best fitting model according to the Extended Bayesian Information Criterion; Chen & Chen, 2008). We visualized the network models using the *qgraph* package (Bringmann et al., 2013), and tested whether edges were stable across bootstrapped estimations based on subsamples of the data using the *bootnet* package (Epskamp, Borsboom, & Fried, 2017).

Second, we compared the connectivity of the three group networks formally, using the *NetworkComparisonTest* package (NCT; van Borkulo, 2017) consisting of 1) the test of global strength invariance (i.e., whether the networks differed in overall strength of all associations between variables), 2) the test of network structure invariance (i.e., whether the networks differed in how edges were distributed), and – in case the two first tests were significant – 3) the test of edge invariance (i.e., whether individual edges differed in strength).

Third, we explored whether there were differences in the centrality of variables between the three groups. We limited the interpretation of centrality statistics to strength centrality (i.e., the number and strength of a node's direct relationships with other nodes), since bootstrapped stability analyses indicated that other centrality statistics were too instable across subsamples of the data. When interpreting node centrality, we further used bootstrapped strength centrality statistics and strength centrality significance tests (i.e., we tested whether nodes were central in bootstrapped subsamples and whether the nodes were significantly more central than other nodes in the network).

Lastly, we ran a cluster detection algorithm to explore differences in the structure of connectivity across the three groups using the *igraph* package (Csardi & Nepusz, 2006). Clusters of nodes represent more strongly connected subnetworks in the larger network. We used the *walktrap* algorithm, which identifies clusters of nodes through random walks in the network (i.e., the algorithm moves stepwise between connected nodes in the network, and this creates patterns of nodes in the network that the walk procedure more often gets "trapped" in).

3.4.3 Clinical study design and analyses (Study III)

Participants in the mindfulness-based condition (MB; *n* = 20) and the scheduled sex and motivations condition (SS; *n* = 30) were scheduled for a first session immediately. Waiting list participants (*n* = 20) were randomly allocated to one of

the two treatment conditions and scheduled for a first session eight weeks after being contacted. Survey data were collected through online surveys before the first session (*pre*), after the final session (*post*), as well as three months and six months after the final session. Waiting list participants additionally completed a survey eight weeks before the first session.

We carried out all analyses in Study III with the software IBM SPSS Statistics 22.0 (IBM Corp, 2013). We compared the differences between *pre* and *post* scores using analysis of covariance (ANCOVA). In the ANCOVAs, we used *post* scores as the dependent variable, treatment condition as the between-groups factor, and *pre* scores as covariates (in order to reduce error variance; Dimitrov & Rumrill, 2003). We further calculated Cohen's *d* effect sizes with confidence intervals for pairwise comparisons between the conditions, using the adjusted *post* score means estimated in the ANCOVA. We calculated both per-protocol results (PP; including only participants who did not drop out of the study) and intention-to-treat results (ITT; carrying forward the last observation for participants with missing data, regardless of whether the individual received the intervention or not). We further checked whether the treatment effects were clinically significant on an individual level, considering an improvement of at least one-half of the measure's *SD* between *pre* and *post* to represent a clinically significant improvement (Norman, Sloan, & Wyrwich, 2003). In the *pre-post* comparisons, waiting list participants were not added to the treatment conditions as the waiting list condition served as its own group.

Further, we conducted follow-up analyses three and six months after the intervention. In order to increase power, waitlist participants were added to the treatment conditions in these follow-up analyses. Consequently, these analyses were conducted separately from the *pre-post* comparisons. We used paired-samples *t* tests to compare within-group differences (i.e., comparing *pre* scores to follow-up scores within the treatment conditions) and independent samples t tests to compare between-group differences (i.e., comparing follow-up scores between the two treatment conditions).

4 Results

4.1 Temporal mean change in sexual desire (RQ1)

In Study I, women in the full sample reported a mean level of 3.27 (SD = 0.92) on the sexual desire domain of the FSFI at T1. Women reported significantly less sexual desire at T2 than at T1 (ΔM = −0.27, ΔSD = 0.09, p < .001). Note that the mean change presented above differs slightly compared to the mean change reported in the original study, as the original study used latent factor means in the calculations. Here, in order to present an informative value for the mean at T1, we chose to calculate the mean without using the latent model, as the latent model constrained the mean at T1 to zero.

4.2 Temporal stability of sexual desire (RQ2)

In Study I, the sexual desire domain had a standardized parameter estimate of β = .279 (SE = .041, p < .001) between the two time points in the full sample SEM analyses, suggesting that approximately 7.8% (β^2 = .078) of the variance in the sexual desire domain measured at T2 was explained by the same domain at T1. Compared to the other domains, sexual desire was the second least stable domain, after sexual satisfaction for which approximately 1.8% of the variance at T2 was explained by sexual satisfaction at T1. In contrast, orgasm function was the most stable domain with approximately 20.0% of the variance at T2 being explained by orgasm function at T1. In summary, all sexual function domains – and especially the sexual desire domain – were fairly unstable, with most of the variance being explained by something other than the previous level of sexual function in the same domain.

4.3 Possible causal effects between sexual desire and other sexual functions (RQ3)

In Study I, sexual desire surprisingly had a significant negative effect on lubrication (β = −.077, SE = .037, p = .037) and intercourse-related pain (β = −.088, SE = .040, p

= .027) in the full sample, so that higher levels of sexual desire at T1 predicted more lubrication difficulties and more intercourse-related pain at T2. Moreover, orgasm had a positive effect on sexual desire (β = .084, *SE* = .034, *p* = .015), so that higher orgasm function at T1 predicted higher levels of sexual desire at T2. It should be noted, however, that these cross-time/cross-domain effects explained only 0.6–0.8% of the variance in the domains at T2.

4.4 The role of relationship status in temporal change of sexual desire (RQ4)

Means for the three relationship status groups in Study I (i.e., women who were in a relationship with the *same partner* at both time points, women who were in a relationship with a *new partner* at T2, and women who were *single* at T2) are presented in Figure 3.
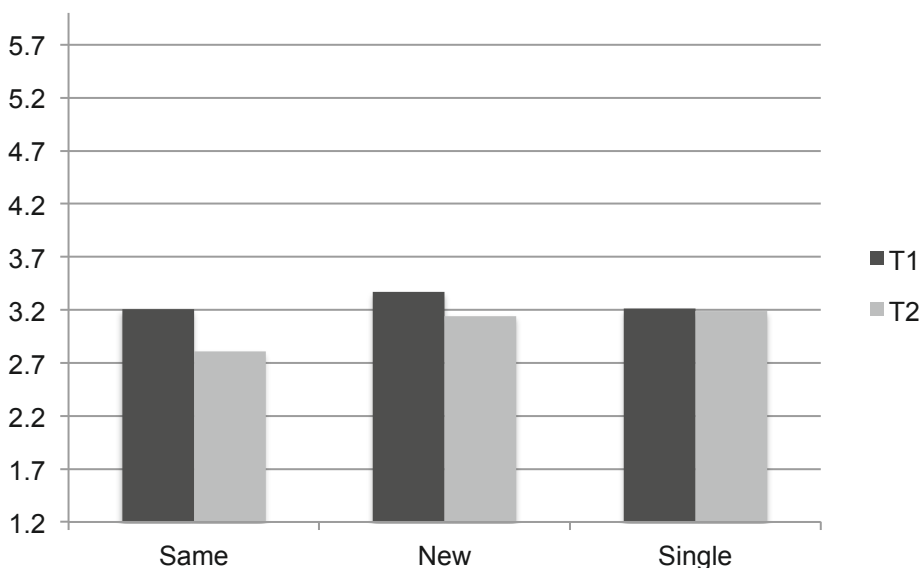

Figure 3. Mean scores on the Female Sexual Function Index desire subdomain for the three relationship groups of women who were in a relationship with the same partner at both time points, women who were in a relationship with a new partner at T2, and women who were single at T2. T1 = time point one in 2006, T2 = time point two in 2013.

Women in the *new partner* group (n = 873) reported a mean level of 3.37 (SD = 0.96) on the sexual desire domain at T1, whereas women in the *same partner* group (n = 964) reported a mean level of 3.21 (SD = 0.86), and women in the *single* group (n = 336) reported a mean level of 3.21 (SD = 0.97). The means of the *same partner* and *single* groups differed significantly from the mean of the *new partner* group (p < .001; p = .012). Compared to T2, women in the *same partner* group reported the largest decrease in sexual desire between the two time points (ΔM = −0.40, ΔSD = 0.04, p < .001). Women in the *new partner* group also reported a decrease in sexual desire between the two time points (ΔM = −0.23, ΔSD = 0.09, p < .001). However, women in the *single* group did not report any significant changes in the level of sexual desire between the two time points (ΔM = −0.02, ΔSD = 0.13, p = .872). Note that the mean changes presented above differ slightly compared to the mean changes reported in the original study, as the original study used latent factor means in the calculations. Here, in order to be able to compare baseline means between the three groups, we chose to calculate the means without using the latent model, as the latent model constrained the means at T1 to zero in all groups.

For women in the *same partner* group, approximately 8.2% (β^2 = .082) of the variance in the sexual desire domain at T2 was explained by the same domain at T1. For women in the *new partner* group, approximately 5.1% (β^2 = .051) of the variance in the sexual desire domain at T2 was explained by the same domain at T1. For women in the *single* group, approximately 11.7% (β^2 = .117) of the variance in the sexual desire domain at T2 was explained by the same domain at T1.

For women in the *same partner* group, sexual desire had a significant negative effect on intercourse-related pain (β = −.130, SE = .053, p = .014), so that higher levels of sexual desire at T1 predicted more intercourse-related pain at T2. Furthermore, for women in the *same partner* group, sexual desire had reciprocal effects with orgasm, so that higher orgasm function at T1 predicted higher levels of sexual desire at T2 (β = .150 SE = .056, p = .007), and that higher levels of sexual desire at T1 predicted lower orgasm function at T2 (β = −.104, SE = .043, p = .016). No significant cross-time/cross-domain effects were found for the two other relationship status groups. Of the significant parameter estimates in the *same partner* group, only the one from desire at T1 to orgasm at T2 remained significant when comparing the groups statistically (i.e., equating parameter estimates resulted in a significant decrease in model fit).

4.5 Network structure depending on change in sexual desire (RQ5)

Symptom network models for the three groups in Study II (i.e., women whose sexual desire *decreased*, *increased*, or remained *stable* between the two time points) at T1 are visualized in Figure 4. The *decrease* network included somewhat fewer edges than the *increase* and *stable* networks (22 vs. 28 and 27). The overall network connectivity was somewhat less strong for the *stable* group than the *decrease* and *increase* groups (0.04 vs. 0.06 and 0.08). Moreover, the edge between body dissatisfaction and sexual distress was stronger in the *decrease* and *increase* groups than in the *stable* group. Note that all associations between variables (i.e., edges) in the network estimations represent partial correlations, that is, the association between two variables after controlling for all other variables included in the network.

Node strength centrality estimates at T1 are presented in Figure 5. Body dissatisfaction was more central (i.e., had more and/or stronger associations with other symptoms in the network) in the *decrease* and *increase* groups than in the *stable* group. Furthermore, intercourse-related pain was more central in the *decrease* group than the *increase* group – but not more central than in the *stable* group.

Network clusters (i.e., subgroups of nodes with stronger associations) at T1 are presented in Figure 6. The number of separate clusters was 4 in the *decrease* network, 6 in the *stable* network, and 8 in the *increase* network, indicating that changes in a node with outgoing associations to other nodes could spread faster across the whole network in the *decrease* group than in the other two groups, as such changes would presumably first spread within the clusters.

Overall, however, the network estimations were fairly similar across the three groups, partly contradicting our hypotheses (H1–H3) that the group would show different patterns of relationships between individual variables in the network. Moreover, when formally comparing the network connectivity across the groups with the *NetworkComparisonTest*, we found no significant differences in terms of overall strength of all associations in the networks (decrease vs. stable $p = 0.06$; decrease vs. increase $p = 0.10$, stable vs. increase $p = 0.93$), and no significant differences in terms of how the edges were distributed in the networks ($p = 0.53$, 0.22, and 0.62).
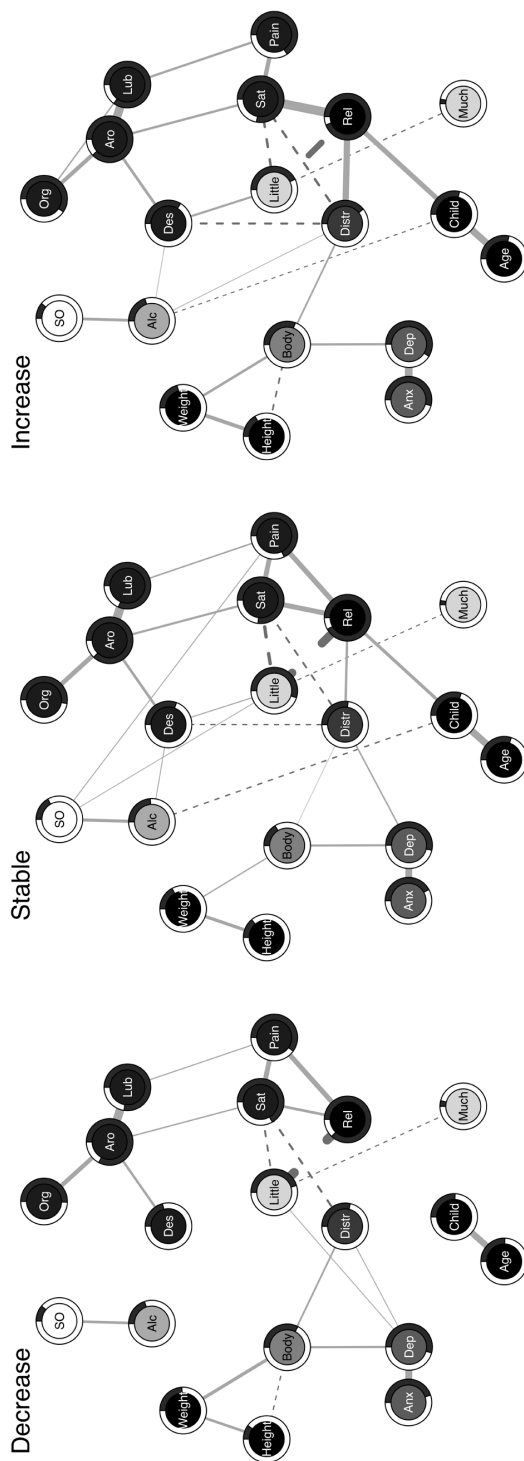
Figure 4. Mixed graphical model networks at the first time point for the groups of women whose desire decreased, increased, or remained stable between the two time points seven years apart. Solid edges indicate positive associations and dashed edges indicate negative associations. Predictability of a variable is represented by a pie chart around the respective node; a fully filled pie chart (dark) indicates perfect predictability. The different shadings inside the nodes illustrate the subscales within the same questionnaire, with demographic questions all illustrated in black. Child = number of children, Des = sexual desire, Aro = sexual arousal, Lub = lubrication, Org = orgasm function, Sat = sexual satisfaction, Pain = intercourse-related pain, Distr = sexual distress, Dep = depression, Anx = anxiety, Body = body dissatisfaction, Alc = alcohol use, Little = too little sexual activity, Much = too much sexual activity, SO = sociosexual orientation, Rel = relationship status. The figure is reprinted from Gunst, Werner et al., 2018.
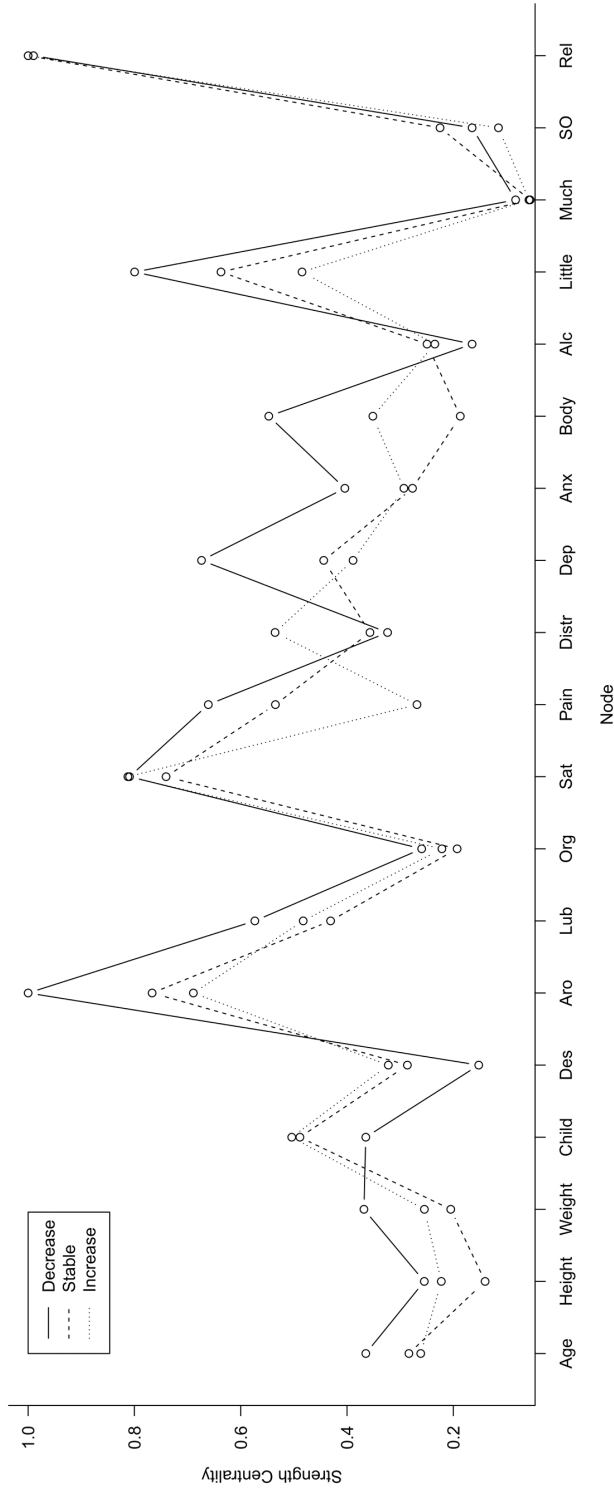
Figure 5. Node strength centrality at the first time point for the groups of women whose desire decreased, increased, or remained stable between the two time points seven years apart. Child = number of children, Des = sexual desire, Aro = sexual arousal, Lub = lubrication, Org = orgasm function, Sat = sexual satisfaction, Pain = intercourse-related pain, Distr = sexual distress, Dep = depression, Anx = anxiety, Body = body dissatisfaction, Alc = alcohol use, Little = too little sexual activity, Much = too much sexual activity, SO = sociosexual orientation, Rel = relationship status. The figure is reprinted from Gunst, Werner et al., 2018.
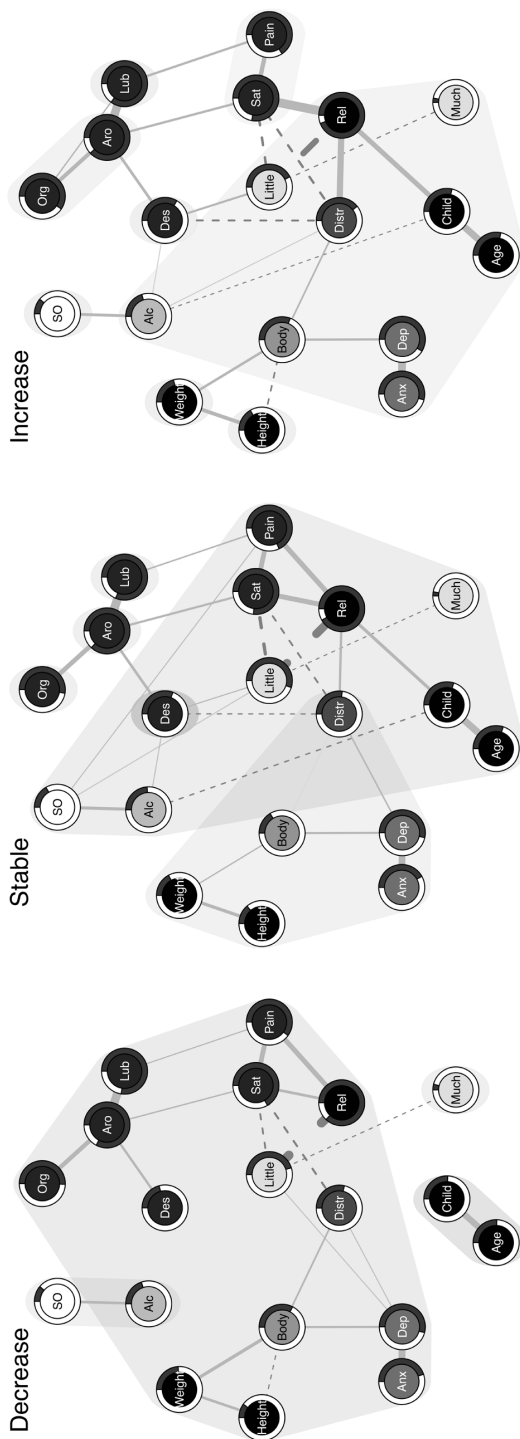
Figure 6. Node clustering at the first time point for the groups of women whose desire decreased, increased, or remained stable between the two time points seven years apart. Note that nodes that are covered by two clusters only belong to one of the clusters. Single nodes are also considered separate clusters. Child = number of children, Des = sexual desire, Aro = sexual arousal, Lub = lubrication, Org = orgasm function, Sat = sexual satisfaction, Pain = intercourse-related pain, Distr = sexual distress, Dep = depression, Anx = anxiety, Body = body dissatisfaction, Alc = alcohol use, Little = too little sexual activity, Much = too much sexual activity, SO = sociosexual orientation, Rel = relationship status. The figure is reprinted from Gunst, Werner et al., 2018.

4.6 General network structure patterns relevant to sexual desire (RQ6)

We observed some similarities in network structure across the three groups in Study II with relevance to sexual desire. In other words, the following results are related to sexual desire in general, regardless of future changes in sexual desire. First, sexual desire and sexual arousal showed different patterns of edges with other nodes in the network (see Figure 4). Sexual arousal seemed to be more closely related to other sexual function domains (orgasm function and lubrication), whereas sexual desire seemed to be more closely related to sexual distress, alcohol use, and too little sexual activity (at least in the stable and increase groups). Second, sexual distress seemed to act as a bridge between more general psychological distress (i.e., the measures of anxiety, depression, and body dissatisfaction) and sexual function. Third, across groups, hormonal contraception was not associated with any other nodes (and thus excluded from the final analyses) except relationship status in the increase group (i.e., women that were in relationships were more likely to use hormonal contraceptives in the increase group). Finally, in all groups, the variables in the network explained only a minority (21–34%) of the variance in the sexual desire node.

4.7 Replication of network models (RQ7)

In Study II, the general network structure patterns across the three groups replicated well at T2. However, the results concerning differences between the three groups seemed to partially reverse at T2. The *stable* network now included fewer edges than the *decrease* and *increase* networks (22 vs. 28 and 26). The edge between body dissatisfaction and sexual distress was now only weaker in the *stable* group when compared to the *increase* group (i.e., not when compared to the *decrease* group). Body dissatisfaction and intercourse-related pain were now less central in the *decrease* group than the *increase* and *stable* groups. Lastly, the number of separate clusters was now 4 in the *decrease* network, 2 in the *stable* network, and 2 in the *increase* network.

4.8 Effects of the treatment intervention (RQ8)

According to our hypothesis (H4) in Study III, women in both treatment conditions reported significant increases in sexual desire at *post* (i.e., immediately after the intervention) assessed with the FSFI, both in the PP analyses ($p = .006$; d_{MB} = 0.86; d_{SS} = 1.06) and the ITT analyses ($p = .015$; d_{MB} = 0.75; d_{SS} = 0.82), when compared to the waitlist control group. Moreover, both treatment conditions

reported significant increases in sexual desire assessed with the SIDI-F in the PP analyses (p = .022; d_{MB} = 1.05; d_{SS} = 0.73), whereas only the MB condition reported significant increases in the ITT analyses (p = .035; d = 0.85). Approximately half of the participants who provided responses at *post* reached a clinically significant change in sexual desire (49% FSFI; 50% SIDI-F), whereas the number of participants who reached a clinically significant change during the waitlist period was somewhat lower (10% FSFI; 40% SIDI-F). The participants' own evaluation of homework compliance did not predict increases in sexual desire. However, satisfaction with treatment significantly predicted increases in sexual desire (FSFI p = .033; SIFI-F p = .040). The item-level baseline means for the treatment outcomes did not time indicate floor effects (i.e., no item-level means were equal to the lower endpoint of the scale).

Among the secondary outcomes at *post*, both treatment conditions reported significant improvements in sexual distress in both the PP (p = .007; d_{MB} = 0.87; d_{SS} = 1.00) and the ITT analyses (p = .015; d_{MB} = 0.84; d_{SS} = 0.76). Furthermore, both treatment conditions reported significant improvements in sexual satisfaction (p = .047; d_{MB} = 0.74; d_{SS} = 0.75) and total sexual function (p = .046; d_{MB} = 0.71; d_{SS} = 0.74) in the PP analyses, but not in the ITT analyses. No significant effects were found for any of the other secondary outcomes at *post* (p's > .05). In summary, these results partly supported our hypothesis about improvements in secondary outcomes (H6).

In the follow-up analyses six months after the intervention, both treatment conditions reported sustained improvements in sexual desire assessed with the FSFI, in both the PP (p_{MB} = .020; p_{SS} = .018) and ITT (p_{MB} = .005; p_{SS} < .001) analyses compared to before treatment (*pre*). Moreover, both treatment conditions reported improvements in sexual desire assessed with the SIDI-F in the ITT analyses (p_{MB} = .001; p_{SS} = .001), whereas only the MB condition reported improvements in sexual desire assessed with the SIDI-F in the PP analyses (p_{MB} = .014; p_{SS} = .065). Among the secondary outcomes at the six-month follow-up, both treatment conditions reported improvements in sexual distress (PP: p_{MB} = .020; p_{SS} = .017; ITT: p_{MB} = .001; p_{SS} < .001), total sexual function (PP: p_{MB} = .001; p_{SS} = .007; ITT: p_{MB} = .001; p_{SS} < .001), sexual arousal (PP: p_{MB} = .001; p_{SS} = .015; ITT: p_{MB} < .001; p_{SS} < .001), and lubrication (PP: p_{MB} = .001; p_{SS} = .013; ITT: p_{MB} = .001; p_{SS} = .001) in both the PP and ITT analyses, as well as improvements in sexual satisfaction (p_{MB} = .017; p_{SS} = .024) and orgasm function (p_{MB} = .010; p_{SS} = .002) in the ITT analyses. Between-group analyses at follow-up revealed no significant differences between the two treatment conditions, except for symptoms of anxiety at six months (which did not show any significant change in the treatment conditions at any measurement point). Note that the waitlist participants were added to the treatment conditions in the follow-up analyses.

4.9 The role of scheduled sex and motivations for sex (RQ9)

Despite the minor differences in significant outcomes in Study III between the two treatment conditions described above, we found no statistically significant differences between the two treatment conditions when conducting between-group analyses. This result contradicts our hypothesis that participants in the SS condition would have greater improvements in sexual desire (H5).

However, participants in the SS condition rated exercises encouraging sex with the partner among the more useful type of exercises ($M = 3.96$, $SD = 1.29$). On average, these exercises were rated as significantly more useful than information about sexuality ($M = 3.25$, $SD = 1.35$), exercises focusing on body image ($M = 3.21$, $SD = 1.34$), and exercises focusing on touching one's own body ($M = 3.21$, $SD = 1.29$), and as useful as exercises focusing on contributing factors ($M = 3.86$, $SD = 1.15$), exercises focusing on the relationship and communication ($M = 3.71$, $SD = 1.15$), exercises focusing on thoughts, feelings, and behaviors ($M = 4.00$, $SD = 1.05$), and mindfulness exercises ($M = 3.64$, $SD = 1.42$).

5 Discussion

The present thesis aimed at 1) improving the understanding of the change over time in sexual desire and predictors of low sexual desire in women, and 2) evaluating brief psychological treatment interventions for women with low sexual desire. To achieve the first aim, cross-lagged structural equation models and network analysis models were fitted to large-scale population-based longitudinal survey data provided by Finnish women at two time points seven years apart. To achieve the second aim, two psychological intervention conditions were evaluated in a clinical sample of 70 women reporting low and distressing sexual desire.

The group of studies included in the present thesis presents with several methodological strengths. Among these are large, longitudinal data sets with high statistical power, validated questionnaires covering a broad range of sexuality-related aspects, and statistical approaches that account for biases such as, for instance, measurement error, treatment selection bias, and spontaneous improvement in treatment participants. To our knowledge, Study II is also the first to use a symptom network approach on sexual function, setting the stage for future symptom network studies in the field. In the following section, results from the present group of studies are discussed and limitations in them are considered.

5.1 Temporal change in sexual desire

In Study I, the level of sexual desire decreased somewhat between the two time points in the full sample (RQ1). This is in line with previous studies, reporting a decline in sexual desire with age (Hayes & Dennerstein, 2005). Noteworthy, our sample was fairly young, with a mean age of about 26 years at the first time point, making it likely that the decrease is not explained by factors related to menopausal transition (at the latter time point, only 2% of the women were 45 years or older). There is, however, a broad range of factors not accounted for in Study I that might help explain the observed decrease in sexual desire over time. For instance, aspects such as having children and developing one's career become especially relevant for

women in their late 20s and 30s – both aspects that could contribute to fatigue and stress (e.g., Åkerstedt, Fredlund, Gillberg, & Jansson, 2002; Nomaguchi & Milkie, 2003). Preliminary cross-time analyses in the GSA data set on the effect of having children on changes in sexual desire support the suggestion that having children would have a negative effect on sexual desire (Gunst, Nylander, Karlsson, Ventus, & Jern, 2018).

The level of sexual desire at the first time point explained only 7.8% of the variance in sexual desire at the second time point seven years later (RQ2). This result suggests that sexual desire is highly variable over time, at least at group-level, with most of the variance in the level of sexual desire being explained by something else than previous level of sexual desire. The high temporal variability in the levels of sexual desire is perhaps not surprising, considering that previous literature indicate that women's sexual desire is a fluctuating trait that is sensitive to the environmental context (e.g., Leiblum, 2002; Levine, 2002). However, previous empirical studies have mainly focused on short-term fluctuations related to the menstrual cycle (Brown et al., 2011) and changes in sexual function during menopause (Burri et al., 2015; Hayes & Dennerstein, 2005), leaving the question of long-term temporal stability in premenopausal women's sexual desire unanswered. It is worth noting, however, that our sample might represent a specific age group of young adults that generally experiences several larger changes in life, resulting in more unstable levels of sexual desire when compared to other age groups. Partly in line with this hypothesis, Burri et al. (2015) found the that level of sexual desire explained around 12% (β = .35) of the variance in sexual desire four years later in a sample of 241 peri- and postmenopausal women. This difference could, however, also be due to the somewhat shorter time span between the two time points (four years vs. seven years). Still, sexual desire also showed high variability in the study by Burri et al. (2015), supporting our results indicating that women's sexual desire is highly variable over time. It is moreover worth noting that the sample used in our study was nonclinical. It could be, that levels of sexual desire are more stable in clinical subgroups. For instance, in a study by Ventus et al. (2017) assessing the temporal stability of premature ejaculation symptoms in men, the authors found that the temporal stability of ejaculation latency time was moderate (β = .58) in a nonclinical sample assessed six years apart, whereas it was high (β = .83) in a clinical sample assessed three years apart. Here, the effect here could, however, also at least partly be due to the longer time span for assessing the stability in the nonclinical sample.

Finally, the fact that most of the variance was explained by something other than previous levels of sexual desire can be seen in an optimistic light with regards to the role of interventions for low sexual desire: Our results suggest that sexual desire is a highly changeable trait and thus likely to be responsive to (clinically)

induced changes. As most of the variance in the levels of sexual desire was explained by something other than previous levels of sexual desire, the next question would perhaps be which factors that contribute to most of the variance in the level of sexual desire.

5.2 Predictors of change in sexual desire

In Study I, we found that higher orgasm function at the first time point predicted higher levels of sexual desire at the second time point seven years later (RQ3). This effect was, however, small, with only 0.7% of the variance in sexual desire at the second time point being explained by orgasm function at the first time point. In Study II, we did not find any significant differences in how sexual desire was associated with other sexual functions between the groups of women whose desire changed or remained stable over time. In other words, it seems that prior functioning in other domains is not a good predictor of future levels of sexual desire, at least in the long term.

In Study II, on the other hand, body dissatisfaction was more central at the first time points in the groups whose desire later changed than in the group whose desire remained stable over time. Moreover, body dissatisfaction and sexual distress had a stronger relationship in the groups whose desire later changed than in the group whose desire remained stable over time (RQ5). These results suggest that body dissatisfaction could precipitate changes in sexual desire – if the associations represented outgoing causal relationships from body dissatisfaction to other symptoms represented causal relationships. If this was the case, then interventions targeting body dissatisfaction could be useful in clinical work with low sexual desire. When comparing the results concerning body dissatisfaction in Study II to the results from Study III, however, exercises focusing on body image was not rated among the most useful components by participants: in both conditions, body image exercises were rated as less useful than exercises focusing on the relationship and communication, as well as exercises focusing on potential contributing factors. In the scheduled sex and motivations condition, body image exercises were also rated as less useful than exercises focusing on thoughts, feelings and behaviors, as well as exercises encouraging sex. It is worth noting that exercises focusing on body image were among the components that had the most variability among participants' ratings, suggesting that some participants found the component very useful whereas others did not. It is also worth noting that the components focusing on body image were few in the present study, which could have affected how participants rated them, and thus it is possible that an intervention more focused on body image issues could have a desire-improving effect. At a minimum, routine

questions about potential body image issues could be valuable when working with women's low sexual desire.

In Study II, we also observed that intercourse-related pain was more central in the group of women whose desire later decreased than in the group of women whose desire later increased, suggesting that intercourse-related pain could precipitate decreases in sexual desire (RQ5). If these associations indeed represent outgoing causal relationships from intercourse-related pain to other symptoms, then highlighting the relationship in clinical work could help mitigate decreases in sexual desire due to chronic intercourse-related pain, and screening for and targeting pain could be appropriate in interventions for low sexual desire. In Study III, reporting frequent intercourse-related pain was applied as an exclusion criterion. Whereas a more homogenous study sample has the advantage of making the sample less susceptible to variability in treatment response due to co-occurring conditions, a consequence of this exclusion criterion is decreased external validity (i.e., the study sample likely differed somewhat from the clients that are seen in routine clinical practice; McHugo et al., 2006). Irrespective of a possible causal direction, the reported comorbidity between sexual desire disorders and sexual pain disorders in clinical samples is still fairly high (Dogan, 2009; Nobre, Pinto-Gouveia, & Gomes, 2006).

The aforementioned results indicating that body dissatisfaction and intercourse-related pain could predict changes in sexual desire should, however, be interpreted with caution, as the formal group difference test (i.e., the Network Comparison Test, NCT; van Borkulo, 2017) did not show significant differences in network structure between the three groups (i.e., the networks did not seem to differ in overall strength of all associations between variables or in how edges were distributed in the network). On the other hand, the potential group differences appeared after regularization was applied to the networks, suggesting that they do not represent spurious results. The NCT also uses a slightly different estimation method than the Mixed Graphical Model, and the test requires considerable power in order to detect differences between groups. As networks analyses, including Study II, are commonly of a more exploratory nature without an expected structure of the network, a priori sample size estimations are often not feasible (Epskamp & Fried, 2017). Replication studies are, nonetheless, required in order to confirm the potential differences between the groups. It is also worth noting that, contrary to our hypotheses (H1–H3), the networks were in general very similar across groups. The similarities also replicated well at the second time point, whereas the observed group differences related to body dissatisfaction and intercourse-related pain did not replicate (RQ7). It is, however, possible that the groups at the second time point were not directly comparable to the groups at the first time point (as discussed further in the Limitations section).

Overall, the variables included in our models in Studies I–II failed to explain the majority of the variance in the level of sexual desire. Perhaps surprisingly, less than half of the variance in the level of sexual desire was explained by variables included in the networks in Study II – this in spite of the fact that the models included several relevant correlates of sexual desire. The model explained the variances in all other sexual function domains better than the variance in levels of desire. This raises the question about which factors explain the remaining part of the variance. Although the network models covered several relevant correlates of sexual desire, there were previously correlated aspects that were not included in the networks. Some potentially important aspects not included were, for instance, levels of stress and fatigue (Finkelstein et al., 2007; Laumann et al., 1999; Yeniel & Petri, 2014), information about physical health (American Psychiatric Association, 2013), and more detailed information about the intimate relationship such as feelings for the partner (Dennerstein et al., 1999), sexual compatibility (Witting, Santtila, Varjonen, et al., 2008) and sexual problems and dysfunctions experienced by the partner (Fugl-Meyer & Fugl-Meyer, 2002, McCabe & Goldhammer, 2012). Especially relationship-related factors could be of importance, considering the observed role of relationship status that will be discussed next.

5.2.1 The role of relationship status

In the present group of studies, relationship status (i.e., whether the individual has an intimate relationship or not) seemed to play a significant role with regards to sexual desire and sexual function in women. In Study II, we found relationship status to be one of the most central variables in the networks, suggesting that relationship status plays an important role in female sexual function. Relationship status was central regardless of whether the woman's sexual desire changed or remained stable over time, implying that it is a central aspect of sexual function overall. However, as the networks were cross-sectional, possible causal associations between relationship status and other aspects in the network remain unclear. It could be, that relationship status is more likely to affect other study variables causally, for instance so that having a sexual partner has a positive, causal effect on sexual satisfaction. However, it is also conceivable that certain study variables have causal effects on relationship status, for instance so that experiencing intercourse-related pain makes it more likely for women to avoid sexual relationships. It is, of course, also possible that these relationships do not represent unidirectional causal effects, but that relation status and other study variables associated with it affect each other reciprocally.

In Study I, we noted that relationship status played a significant role with regards to changes in the level of sexual desire (RQ4). Women who were in

relationships at the second time point reported a significant decrease in sexual desire, whereas women who were single at the second time point did not. One potential group-level difference between women in relationships and single women at the second time point could be differences in the rates of having children (i.e., with women in relationships at the second time point more likely to have children). Preliminary analyses investigating this do not, however, support the hypothesis that having children would explain these observed group differences (Gunst, Nylander et al., 2018).

We also noted that women who had entered a relationship with a new partner between the two time points reported higher levels of sexual desire than the two other groups at the first time point. It is plausible that the group of women who had entered new relationships could broadly represent women with a more liberal sociosexual orientation – a characteristic that has been associated with higher levels of sexual desire (Ostovich & Sabini, 2004). When testing this hypothesis in a separate analysis, women in a relationship with a new partner indeed had less restricted sociosexual orientations compared to women who were in a relationship with the same partner ($p < .001$), but not compared to women who were single at the later time point ($p = .486$). This explanation also does not explain why women in new relationships reported a decrease in sexual desire between the two time points. It is worth noting that we did not have information about the number of sexual partners during the time frame of seven years, and that the group consisting of single women also included women who had been in relationships at the first time point (otherwise, the group sizes would have been too small for statistical analyses when splitting the group of single women into two different subgroups based on whether or not they were in a relationship at T1 – the single group was already the smallest to begin with). Moreover, we did not have any information about whether those in a relationship with the same partner at both time points had any temporary changes in their relationship status and/or if they had any other partners during the seven years.

We observed that women who were single at the second time point had slightly more stable levels of sexual desire: for single women, 12% of the variance in sexual desire at the second time point was explained by previous sexual desire, compared to 8% and 5% for women in a relationship with the same or with a new partner. One possible reason for this could be that women with and without current intimate relationships conceptualize sexual desire differently, with women in relationships spontaneously defining sexual desire as something happening in relation to the current partner (i.e., *How much do I desire sex with my partner?*), and with single women looking more broadly at sexual desire (e.g., *How much do I desire any sexual activity?*). If this were the case, then reports of sexual desire for women in relationships would depend more on factors related to the specific

relationship, such as, for instance, feelings for the partner and problems in the relationship. Similarly, it could be that single women spontaneously include aspects of physical intimacy more broadly when defining partnered sexual experiences, whereas women in relationships make clearer distinctions between non-sexual physical intimacy (e.g., hugging) and sexual physical intimacy (e.g., intercourse).

5.3 Effects of the treatment intervention

In the clinical study, we found that women in both treatment conditions reported improvements with medium to large effect sizes in sexual desire, sexual distress, and total sexual function immediately after treatment (RQ8). This was also the case when including participants who dropped out during treatment in the analyses (i.e., the intention-to-treat analyses). Further, those who did not drop out also reported significantly higher sexual satisfaction immediately after treatment (i.e., when including those who dropped out, this result was not significant). This suggests that those who completed treatment reached a higher sexual satisfaction – however, it could also be that being sexually satisfied contributed to the likelihood of completing the treatment. At the six-month follow-up, both treatment conditions reported sustained improvements in sexual desire, sexual distress, total sexual function, as well as additional significant improvements in sexual arousal and lubrication. Moreover, both conditions also reported significant improvements in sexual satisfaction and orgasm function at the six-month follow up, when taking into account those who dropped out from reporting. These results add to the literature suggesting that brief multimodal mindfulness-based cognitive psychological interventions are promising for treating women's low sexual desire and important secondary symptoms.

Worth noting, however, is that we did not find significant improvements for some of the secondary outcomes, either immediately after treatment or at the follow-ups. These secondary outcomes were intercourse-related pain, relationship satisfaction, and symptoms of anxiety and depression. A possible explanation for this could be that participants with major relationship problems, self-reported psychiatric diagnoses, and/or frequent intercourse-related pain were excluded from our study. As a consequence, the women in our study did not score that low on these domains before treatment. Our results are in line with those of Brotto and Basson (2014), who also did not find any significant improvements in relationship satisfaction. Moreover, Brotto and Basson did not find any significant treatment-related decreases in depressive symptoms (i.e., there was a slight decrease in depressive symptoms in both the control group and the active treatment group, but no group effect was observed). Intercourse-related pain and symptoms of anxiety were not included as secondary measures in the study by Brotto and Basson.

Similar exclusion criteria were applied in the study by Brotto and Basson, which could potentially also help to explain why no significant effects were found. In contrast to Brotto and Basson, we did not find any significant improvements in sexual arousal and lubrication immediately after treatment (we did however find improvements in these domains at the last follow-up, although it should be noted that here, we did not compare the results to the waiting list condition as these participants were also included in the treatment conditions). One possible explanation for the difference immediately after treatment could be slight differences in the study samples. Whereas the study sample by Brotto and Basson consisted of women meeting either the sexual desire disorder or sexual arousal disorder diagnosis (or both) according to the previous version of the DSM, our study sample consisted of women who met the criteria for the combined diagnosis of FSIAD. Another possible explanation could be that the study by Brotto and Basson included additional laboratory testing of sexual arousal, which could have affected the participants' focus on the bodily aspects of their sexual response.

Unexpectedly, we did not find any significant differences between the two treatment conditions in terms of treatment efficacy, suggesting that the additional exercises related to scheduled sex and motivations for sex did not provide any additional treatment benefits to the existing protocol (RQ9). However, a possible effect of these exercises alone was not investigated in our study (i.e., there was no treatment group who was only provided the additional exercises). It could be, that these exercises do have an effect on sexual desire, but that this effect is not seen as additional to the effect already gained by the existing protocol. A recent study by Muise, Boudreau, and Rosen (2017) also found that manipulating the salience of approach-related goals (e.g., to pursue one's own pleasure) compared to avoidance-related goals (e.g., to avoid conflict in the relationship) had a positive effect on sexual desire, further highlighting the importance of motives for engaging in sex. As our study protocol did not explicitly distinguish between approach- and avoidance-related goals, but focused more broadly on the woman's own motives for engaging in sex, this could also have affected our results. Further, one general limitation with psychological treatment interventions like the one in Study III is that it is difficult to pinpoint exactly which components are contributing to an observed treatment effect. As we wanted to investigate the potential *additional* effect of the exercises related to scheduled and motivations for sex, we chose to compare two conditions that both were administered the protocol by Brotto and Basson (2014). It would, nevertheless, also be interesting to study different components of the multimodal approach separately, in order to test if one single component or a smaller group of components could result in similar improvements in sexual desire. If this was the case, it could have practical implications for the treatment of sexual desire. Arguably, less time-consuming interventions are

attractive both for healthcare providers and clients: in our study, lack of time was reported as the most common reason for dropping out of treatment.

An interesting observation from Study III was that participants' self-evaluations of their homework compliance did not predict improvements in sexual desire, implying that there might not be a straightforward association between the amount of work put into participation and the treatment outcome. Brotto and Basson (2014) made a similar observation in their study, reporting no significant association between improvements in sexual desire and homework compliance as rated by the treatment facilitators. It is possible, that the improvements in sexual desire are due to more general aspects of the treatment that were not quantified in our study, such as, for instance, the therapeutic relationship. This would follow the theory of common factors for psychotherapy, suggesting that different evidence-based approaches share many similarities between each other that account for a large part of the treatment effect (Hubble, Duncan, & Miller, 1999). The participants did, however, rate some of the components in the protocol as more useful than others. Among the more useful components were exercises focusing on thoughts, behaviors, and feelings (e.g., exercises with a cognitive behavioral focus), as well as exercises focusing on the relationship and communication (further highlighting the role of the relationship for sexual desire, as discussed above). Interestingly, women who were provided the scheduled sex and motivations for sex exercises rated them among the more useful components, suggesting that the participants, regardless of the fact that they did not provide a noticeable additional treatment effect, considered them valuable.

Approximately half of the participants who provided responses after treatment reached a clinically significant change in sexual desire (defined as at least one-half of the standard deviation of sexual desire between *pre* and *post*; Norman et al., 2003), suggesting intra-individual variability in treatment response. It is likely that low sexual desire has individual variation in etiology (i.e., women differ in terms of what causes decrements in their sexual desire), and as a consequence different interventions work better for different women. Among the subjective ratings of the treatment components, there was also variability of the experienced usefulness of different components. As discussed above, exercises focusing on body image were among the components that had the most variability among participants' ratings, suggesting that some participants found the component very useful whereas others did not. It is possible that these components are especially useful for women struggling with body image issues, but that they do not provide much added value to those women who are satisfied with the appearance of their bodies. Similarly, exercises focusing on touching one's own body as well as components providing information about sexuality also showed some variability in the ratings, suggesting that there were individual differences in how valuable these components were

experienced. Worth noting, however, is that participants' own experiences of useful components might not necessarily correspond to the most effective components. As a comparison, the validity of students' evaluations of effective teaching in higher education has long been questioned; with some studies indicating that students seem to give higher ratings to classes that are experienced as easy (e.g., Brodie, 1998). Similarly, it could be that exercises that were more time-consuming or challenging were not rated as the most useful, even though they could be contributing to improvements in sexual desire. It is also worth noting that although there were significant differences between the participants' evaluations of some of the components, the mean differences of the ratings were fairly small.

It is still unclear how to best identify effective components for the treatment of women's low sexual desire. If the causal factors behind low sexual desire are indeed different in different women, then providing individually tailored interventions could potentially be a fruitful strategy for improving treatment efficacy. One possible way of doing this would be by conducting individual time-series networks, that is, network models applied to intensive longitudinal data from the same individual over a shorter time period (Epskamp, Waldorp, Mõttus, & Borsboom, 2018). These individual networks require a large amount of observations from the same individual (i.e., the number of observations within the individual constitutes the sample size), and these networks rest on the assumption that there is enough variation within the individual among the observed symptoms. Sexual desire would most likely fit the assumption about variability well, as sexual desire indeed seems to be highly variable over time. One advantage of time-series networks, in contrast to group networks, is that they can provide individual estimations of causal effects between symptoms. Such networks can help with conceptualizing the individual's symptom patterns and guiding individual intervention selection (Wigman et al., 2013). For instance, in a hypothetical scenario, these models could show a causal effect from relationship dissatisfaction to sexual distress in one individual, and a causal effect from anxiety to sexual distress in another individual. Consequently, the target for the first individual could be relationship-related factors, whereas target for the second individual could be symptoms of anxiety. In general, group-to-individual generalization has been criticized within research on human subjects, as psychological and social processes usually vary between individuals (Fischer, Medaglia, & Jeronimus, 2018). Individual time-series network conceptualizations have already successfully been tried out for instance in patients with anxious and depressive symptoms (Kroeze et al., 2017), and major depression (Kramer et al., 2014).

5.4 Other observations related to sexual desire

In the following sections, observations related to sexual desire that were not explicitly included among the research questions are discussed.

5.4.1 Sexual desire and arousal

Previous research suggests that sexual desire (commonly conceptualized as a motivational state and interest in sexual behaviors) and sexual arousal (commonly conceptualized as the subjective experience of a physiological sexual response) often overlap on a phenomenological level (Laan & Both, 2008; Prause, Janssen, & Hetrick, 2007). This also touches upon the discussion about whether sexual desire and arousal disorders should be combined or not, as is the case with the combined female sexual interest/arousal disorder in the DSM-5 (American Psychiatric Association, 2013). In the present group of studies, sexual desire and sexual arousal were clearly distinct from one another in terms of their associations with other domains of sexual functions and relevant correlates. In Study II, we observed that sexual desire and sexual arousal showed different patterns of associations with other aspects of sexual functioning in the networks (RQ6), with arousal being more closely related to other aspects of sexual functioning such as orgasm function and lubrication. In Study III, sexual arousal and sexual desire also behaved differently: while we found significant treatment effects for sexual desire immediately after treatment, there were no significant improvements in the sexual arousal domain. It should be noted that our results were based on the Female Sexual Function Index (Rosen et al., 2000) questionnaire, where definitions of sexual desire and sexual arousal are given to the respondent (i.e., sexual desire focuses on motivation, receptivity, and thoughts; whereas sexual arousal is described as being "turned on" during sexual activity), leaving little room for own interpretations of a possible distinction. When following these definitions of sexual desire and arousal, it seems that they represent unique sexual function aspects that might require unique treatment. It is possible that some of the reported overlap between sexual desire and sexual arousal is a natural consequence of an unclear conceptual distinction between these two. For instance, it could be that what a woman initially labels as a lack of sexual desire is really closer to a lack of sexual arousal (i.e., a lack of a subjective experience of a physiological sexual response, rather than a lack of interest in sexual behaviors). For instance, Brotto et al. (2009) found that the majority of (mid-aged) women spontaneously described sexual desire as something that includes physical and genital reactions, and Mitchell et al. (2014) found that the concepts were in many cases blurred when asking both women and men to distinguish between sexual desire and arousal. Our results indicate that sexual

desire and arousal behave quite differently, highlighting the importance of clarifying any conceptual distinctions when assessing sexual function in women seeking help for sexual function difficulties, as a shared understanding sexual desire and arousal cannot be assumed.

5.4.2 Sexual satisfaction and distress

In Study II, we found that sexual distress acted as a "bridge symptom" between more general psychological distress (i.e., the measures of anxiety, depression, and body dissatisfaction) and sexual function (RQ6). This suggests that any association between the indicators of general distress and sexual function was mediated by sexual distress – so that, for instance, body dissatisfaction would only affect sexual function negatively if sexual distress was present or vice versa – that lower sexual function would only affect general distress if sexual distress was present. Another possible explanation could be that both general distress and lower levels of sexual function affect sexual distress, or that sexual distress affects both general distress and sexual function, without a causal relationship between general distress and sexual function. We also observed that sexual satisfaction generally seemed to have a closer relationship to sexual function domains than sexual distress had. This result contradicts a previous study by Stephenson and Meston (2010), in which the authors found sexual distress to be more closely related to sexual function than sexual satisfaction in a clinical sample of women with arousal difficulties. However, the authors did not observe the same relationship in a nonclinical sample, suggesting that sexual satisfaction and sexual distress might have different patterns of associations in clinical versus nonclinical samples. Moreover, in line with the study by Stephenson et al. (2010), we found a somewhat more robust treatment response for sexual distress than for sexual satisfaction in Study III (i.e., a stronger treatment effect and a significant positive effect also in women who dropped out during treatment). Related to the discussion above about differences between sexual arousal and sexual desire discussed, we also observed that sexual arousal was more closely related to sexual satisfaction than was sexual desire, suggesting that the association between sexual desire and sexual satisfaction was mediated by sexual arousal. On the other hand, sexual desire seemed to have a closer relationship to sexual distress (i.e., the relationship was not mediated by sexual arousal, at least in the *stable* and *increase* networks). In other words, women with low sexual desire might only report lower sexual satisfaction if they also experience arousal difficulties, whereas they might report sexual distress regardless of experienced levels of sexual arousal. Here again, it is worth noting that women spontaneously seem to mix the concepts of sexual desire and sexual arousal (Brotto

et al., 2009; Mitchell et al., 2014), which might at least partly explain why this result does not fit clinical observations.

5.4.3 The use of hormonal contraceptives

In Study II, the use of hormonal contraceptives was not associated with any other variables in the networks, except relationship status in the group of women whose levels of sexual desire had increased (i.e., suggesting that women in relationships were more likely to use hormonal contraceptives). In other words, it seems that hormonal contraception does not have a central role in female sexual functioning at group-level (RQ6). This is in line with more recent review papers concluding that only a small percentage of women using hormonal contraceptives report a decrease or an increase in sexual desire (Burrows et al., 2012; Pastor et al., 2013). This subgroup of women reporting a change in sexual desire was not observed in the networks of women whose desire later increased or decreased. This said, results from other studies indicating smaller subgroups of women experiencing changes in sexual desire should not be dismissed.

5.5 Limitations

Some general limitations of the present group of studies should be considered. In Studies I–II, where population-based data sets were used, the extensive time frame of seven years between measurement points limited our ability to investigate short-term changes in sexual desire. It might be more meaningful to study changes in levels of sexual desire and cross-domain effects using more closely situated time points that would capture short-term fluctuations in sexual function (e.g., in relation to stressors of a more momentary nature such as temporary stress and relationship strains). Ideally, this would be done with more measurement points in order to be able to conduct analyses that require at least three measurement points (e.g., latent growth curve models; Duncan, Duncan, & Stycker, 2013). Still, the data set used in Studies I–II is to our knowledge unique with regards to the large number of sexuality-related variables collected for a large sample at more than one time point.

One limitation in Studies II-III was that the no sexual activity responses for the FSFI questionnaire were kept as in the original publication – representing the lower endpoint of the scale. This was done in order to preserve statistical power for the analyses. However, the original scale has also been criticized as it automatically treats sexually inactive respondents as those with the lowest sexual function (Meyer-Bahlburg & Dolezal, 2007). Consequently, this should be kept in mind when interpreting the networks in Study II as well as results regarding the

secondary FSFI outcomes in Study III (as the desire subscale does not require sexual activity).

In Study II, another limitation was that the network groups might not perfectly reflect groups of women with decreased, increased, and stable sexual desire, as there could have existed non-linear fluctuation in levels of sexual desire between the two time points. Moreover, perhaps counter-intuitively, women in the decrease group had higher mean levels of sexual desire at the first time point ($M = 3.45$, $SD = 0.87$) compared to the other groups (increase: $M = 3.10$, $SD = 0.92$; stable: $M = 3.25$, $SD = 0.92$), as those who already scored low on the sexual desire scale could not have further decreases. As a consequence of our study design, the groups at the second time point might not have been directly comparable to the groups at the first time point (at the second time point, the group of women whose desire had decreased resembled a group consisting of women with low sexual desire). This could, at least partly, explain why the group difference observations did not replicate at the second time point. Comparing sexual desire groups based on changes in the way we did could however provide us with information about possible factors precipitating changes in sexual desire, which is arguably relevant from a clinical perspective. An alternative strategy of analyzing group-level cross-sectional networks of women with differing levels of sexual desire could be to compare a group of women with persistent low sexual desire to groups of women with a stable higher level of sexual desire.

In Study III, one limitation was the dropout rate of 25% during treatment. The fairly high number of dropouts in our study could bias the results in favor of a higher treatment effect, as dropout participants would arguably rate the intervention as less efficient. This was also supported by the fact that some of the results that were significant in the per-protocol group at *post* (e.g., sexual satisfaction) were not significant in the intention-to-treat group at *post* (i.e., the intention-to-treat results are most likely punished by the dropouts if a treatment effect is expected). One possible reason for the dropout rate could be that some of the participants reevaluated their motivation to complete the study upon learning about the workload of the study. Lack of time was indeed reported as the most common reason for dropping out. Similar dropout rates have been reported in other intervention studies on sexual difficulties (Mintz et al., 2012; Ventus et al., under review). The dropout rate of our study was, however, higher than the dropout rate of 8% reported by Brotto and Basson (2014). One difference between the studies was that our study sample was recruited mostly through advertisements, whereas the study sample of Brotto and Basson (2014) consisted of participants who were already actively seeking help and as a result possibly had higher intrinsic levels of motivation to participate.

Other limitations of Study III were the lack of assessment of participants' treatment expectations, lack of assessment of homework compliance with regards to the additional exercises in the SS group, as well as lack of assessment of facilitator fidelity to the protocol and quality of the delivery of the two conditions. Especially the quality of the delivery touches upon the issue of treatment studies that are not double-blinded. However, in our study this was not that big of a problem, considering we did not find any results that would support our hypothesis that the scheduled sex and motivations group would have larger improvements in sexual desire. Our exclusion criteria could also affect the generalizability of the results from Study III, as our study sample might not represent women seeking treatment for low sexual desire generally. For instance, not all women experiencing distressing difficulties with sexual desire are in partnered relationships. While we limited the SS exercises to partnered sex, the exercises could potentially also have included solo sex. Finally, one limitation of the clinical sample could have been potential heterogeneity of the sample when including participants from both Sweden and Finland. However, the cultural and political distance between the two countries is small, and the participants in Finland were Swedish-speaking (i.e., they followed the exact same protocol). Further, excluding the Turku participants did not change the significance for improvements in sexual desire.

6 Conclusions and suggestions

The goal of the present thesis was to investigate the temporal nature of sexual desire and predictors of low sexual desire in women, and to evaluate brief psychological interventions for women with low sexual desire.

We observed that the level of sexual desire was variable over time, and that most of the variance was explained by something other than previous level of sexual desire. Moreover, in the network analyses, less than half of the variance in the level of sexual desire could be explained by variables included in the networks. Although these results unfortunately do not tell us which factors contribute to most of the variance in sexual desire, the fact that most of the variance was explained by something other than previous sexual desire is promising with regards to interventions for low sexual desire, as it points towards sexual desire being a changeable trait. It could further be meaningful to study changes in levels of sexual desire and predictors of low sexual desire using more closely situated time points that would capture short-term fluctuations in sexual desire.

In all three studies, we observed that relationship-related factors seemed to play an important role with regards to sexual function and levels of sexual desire. In Study I, the changes in levels of sexual desire differed significantly depending on the women's relationship status, with women in the same relationship for instance showing larger decreases in sexual desire. In Study II, relationship status was one of the most central variables in the networks, suggesting that it is a prominent aspect of sexual functioning. In Study III, exercises focusing on the intimate relationship and communication were highly valued by the participants. In Summary, our results suggest that relationship-related factors should be highlighted in interventions targeting low sexual desire in women.

Participants in both intervention conditions showed significant improvements in sexual desire as well as important secondary outcomes such as sexual distress and sexual satisfaction. This result contributes to the growing literature suggesting that brief multimodal mindfulness-based cognitive psychological interventions are promising treatment alternatives for women with problems related to low sexual desire. We did not find any significant differences between the two intervention conditions in terms of treatment efficacy, suggesting that the additional exercises related to scheduled sex and motivations for sex did not provide additional treatment benefits to the existing protocol. It could, however, be that these

exercises do have an effect on sexual desire that is not seen as additional to the effect already gained by the existing protocol. This was corroborated by the fact that participants who were provided the scheduled sex and motivations for sex exercises rated them among the more useful components. Moreover, we noted that homework compliance did not predict improvements in sexual desire, implying that there might not be a straightforward association between the amount of work put into participation and the treatment outcome. This could imply that the treatment effect were due to more general aspects of the treatment, such as, for instance, the therapeutic relationship.

We also noticed some variability in our treatment results. About half of the participants who provided post-intervention responses reached a clinically significant change in sexual desire, and the participants' ratings of the usefulness of different treatment components also varied between individuals. These results, demonstrating considerable inter-individual variation in treatment response and preferences, suggest that individualized psychological treatments for low sexual desire in women could be the most effective treatment option. While it is still not clear how to best identify which aspects of sexual desire that should be targeted in individually tailored interventions, one potential way of finding central symptoms with causal effects within the individual would be through conducting individual time-series networks estimations that could help guide the individual treatment approach.

References

Abdo, C. H., Valadares, A. L., Oliveira, W. M. Jr., Scanavino M. T., & Afif-Abdo, J. (2010). Hypoactive sexual desire disorder in a population-based study of Brazilian women: associated factors classified according to their importance. *Menopause, 17,* 1114–1121.

Achilli, C., Pundir, J., Ramanathan, P., Sabatini, L., Hamoda, H., & Panay, N. (2017). Efficacy and safety of transdermal testosterone in postmenopausal women with hypoactive sexual desire disorder: a systematic review and meta-analysis. *Fertility and Sterility, 107,* 475–482.

Åkerstedt, T., Fredlund, P., Gillberg, M., & Jansson, B. (2002). Work load and work hours in relation to disturbed sleep and fatigue in a large representative sample. *Journal of Psychosomatic Research, 53,* 585–588.

Ålgars, Monica. (2012). *Shapes and sizes: body image, body dissatisfaction and disordered eating in relation to gender and gender identity.* Åbo Akademi University: Turku, Finland.

Allen, J. P., Litten, R. Z., Fertig, J. B., Babor, T. (1997). A review of research on the Alcohol Use Disorders Identification Test (AUDIT). *Alcoholism: Clinical and Experimental Research, 21,* 613–619.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders: DSM-IV-TR.* Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.).* Washington, DC: American Psychiatric Publishing.

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B. & Monteiro, M. G. (2001). *The Alcohol Use Disorders Identification Test Guidelines for Use in Primary Care. Second Edition.* World Health Organization, Department of Mental Health and Substance Dependence.

Bancroft, J. (2005). The endocrinology of sexual arousal. *Journal of Endocrinology, 186,* 411–427.

Baser, R. E., Li, Y., & Carter, J. (2012). Psychometric validation of the female sexual function index (FSFI) in cancer survivors. *Cancer, 118,* 4606–4618.

Basson, R. (2000). The female sexual response: A different model. *Journal of Sex & Marital Therapy, 26,* 51–65.

Ben Zion, I. B., Tessler, R., Cohen, L., Lerer, E., Raz, Y., Bachner-Melman, R., ... Benjamin, J. (2006). Polymorphisms in the dopamine D4 receptor gene (DRD4) contribute to individual differences in human sexual behavior: desire, arousal and sexual function. *Molecular Psychiatry*, *11*, 782–786.

Bohn, M. J., Babor, T. F., & Kranzler, H. R. (1995). The Alcohol Use Disorders Identification Test (AUDIT): validation of a screening instrument for use in medical settings. *Journal of Studies on Alcohol and Drugs, 56,* 423–432.

Borsboom, D. (2017). A network theory of mental disorders. *World Psychiatry, 16,* 5–13.

Bringmann, L. F., Vissers N., Wichers, M., Geschwind, N., Kuppens, P., Peeters, F., ... Tuerlincks, F. (2013). A network approach to psychopathology: new insights into clinical longitudinal data. *PLos ONE, 8,* e60188.

Brodie, D. A. (1998). Do Students Report that Easy Professors Are Excellent Teachers? *Canadian Journal of Higher Education, 1,* 1–20.

Brotto, L. A. (2010). The DSM Diagnostic Criteria for Hypoactive Sexual Desire Disorder in Women. *Archives of Sexual Behavior, 39,* 221–239.

Brotto, L. A. (2017). Evidence-based treatments for low sexual desire in women. *Frontiers in Neuroendocrinology, 45,* 11–17.

Brotto, L. A., & Basson, R. (2014). Group mindfulness-based therapy significantly improves sexual desire in women. *Behaviour Research and Therapy, 57,* 43–54.

Brotto, L. A., Erskine, Y., Carey, M., Ehlen, T., Finlayson, S., Heywood, M., & Miller, D. (2012). A brief mindfulness-based cognitive behavioral intervention improves sexual functioning versus wait-list control in women treated for gynecologic cancer. *Gynecologic Oncology, 125,* 320–325.

Brotto, L. A., Heiman J. R., & Tolman, D. L. (2009). Narratives of desire in mid-age women with and without arousal difficulties. *Journal of Sex Resarch, 46,* 387–398.

Brotto, L. A, & Yule, M. (2017). Asexuality: Sexual Orientation, Paraphilia, Sexual Dysfunction, or None of the Above? *Archives of Sexual Behavior, 46,* 619–627.

Brotto, L. A, Yule, M. A., & Gorzalka, B. B. (2015). Asexuality: an extreme variant of sexual desire disorder? *Journal of Sexual Medicine, 12,* 646–660.

Brown, S. G., Calibuso, M. J., & Roedl, A. L. (2011). Women's sexuality, well-being, and the menstrual cycle: Methodological issues and their inter-relationships. *Archives of Sexual Behavior*, *40*, 755–765.

Burri, A., Greven, C., Leupin, M., Spector, T., & Rahman, Q. (2012). A multivariate twin study of female sexual dysfunction. *Journal of Sexual Medicine 9,* 2671–2681.

Burri, A., Hilpert, P., & Spector, T. (2015). Longitudinal evaluation of sexual function in a cohort of pre- and postmenopausal women. *Journal of Sexual Medicine, 12,* 1427–1435.

Burri, A., Hysi, P., Clop, A., Rahman, Q., & Spector, T. D. (2012). A genome-wide association study of female sexual dysfunction. *PLoS One*, *7*, e35041.

Burri, A., & Spector, T. (2011). Recent and lifelong sexual dysfunction in a female UK population sample: prevalence and risk factors. *Journal of Sexual Medicine, 8,* 2420–2430.

Burrows, L. J., Basha, M. & Goldstein, A. T. (2012). The effects of hormonal contraceptives on female sexuality: a review. *Journal of Sexual Medicine, 9,* 2213–2223.

Busby, D. M., Christensen, C., Crane, D. R., & Larson, J. H. (1995). A revision of the dyadic adjustment scale for use with distressed and nondistressed couples: Construct hierarchy and multidimensional scales. *Journal of Marital & Family Therapy, 21,* 289–308.

Buster, J. E., Kingsberg, S. A., Aguirre, O., Brown, C., Breaux, J. G., Buch, A., ... Casson, P. (2005). Testosterone patch for low sexual desire in surgically menopausal women: a randomized trial. *Obstetrics & Gynecology, 105,* 944–952.

Carvalho, J., & Nobre, P. (2010). Predictors of women's sexual desire: the role of psychopathology, cognitive-emotional determinants, relationship dimensions, and medical factors. *Journal of Sexual Medicine, 7,* 928–937.

Chen, J., & Chen, Z. (2008). Extended Bayesian information criteria for model selection with large model spaces. *Biometrika, 95,* 759–771.

Clayton, A., Kornstein, S., Prakash, A., Mallinckrodt, C., & Wohlreich, M. (2007). Changes in sexual functioning associated with duloxetine, escitalopram, and placebo in the treatment of patients with major depressive disorder. *Journal of Sexual Medicine, 4,* 917–929.

Clayton, A. H., Segraves, R. T., Leiblum, S., Basson, R., Pyke, R., Cotton, D., ... Wunderlich, G. R. (2006). Reliability and validity of the Sexual Interest and Desire Inventory Female (SIDI-F), a scale designed to measure severity of female hypoactive sexual desire disorder. *Journal of Sex & Marital Therapy, 32,* 115–135.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences (2nd ed.).* Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Cramer, A. O. J., Waldorp, L. J., van der Maas, H. L. J. & Borsboom, D. (2010a). Complex realities require complex theories: Refining and extending the network approach to mental disorders. *Behavioral and Brain Sciences, 33,* 178–193.

Cramer, A. O. J., Waldorp, L. J., van der Maas, H. L. J. & Borsboom, D. (2010b). Comorbidity: a network perspective. *Behavioral and Brain Sciences, 33,* 137–193.

Csardi, G. & Nepusz, T. (2006). *The igraph Software Package for Complex Network Research.* InterJournal.

Cuenca Montesino, M. L., Graña Gómez, J. L., Peña Fernández, M. E., & Andreu Rodríguez, J. M. (2013). Psychometric properties of the Dyadic Adjustment Scale (DAS) in a community sample of couples. *Psicothema, 25,* 536–541.

Daker-White, G. (2002). Reliable and valid self-report outcome measures in sexual (dys)function: a systematic review. *Archives of Sexual Behavior, 31,* 197–209.

Davis, S. R., Davison, S. L., Donath, S., & Bell, R. J. (2005). Circulating androgen levels and self-reported sexual function in women. *JAMA, 294,* 91–96.

Davis, C. M., Yarber, W. L., Bauserman, R., Schreer, G., & Davis, S. L. (1998). Handbook of Sexuality-Related Measures. Thousand Oaks, CA: SAGE Publications Inc.

Dennerstein, L., Lehert, P., Burger, H., & Dudley, E. (1999). Factors affecting sexual functioning of women in the mid-life years. *Climacteric, 2,* 254–262.

Dennerstein, L., Smith, A. M. A., Morse, C. A., & Burger, H. G. (1994). Sexuality and the menopause. *Journal of Psychosomatic Obstetrics & Gynecology, 15,* 59–66.

Derogatis, L., Clayton, A., Lewis-D'Agostino, D., Wunderlich, G., & Fu, Y. (2008). Validation of the Female Sexual Distress Scale-Revised for assessing distress in women with hypoactive sexual desire disorder. *Journal of Sexual Medicine, 5,* 357–364.

Derogatis, L. R. (2001). Brief Symptom Inventory (BSI)-18. *Administration, scoring and procedures manual.* San Antonio, TX: Pearson.

Derogatis, L. R. & Melisarotos, N. (1979). The DSFI: a multidimensional measure of sexual functioning. *Journal of Sex & Marital Therapy, 5,* 244–281.

Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory: An introductory report. *Psychological Medicine, 13,* 595–605.

Derogatis, L. R., Rosen, R., Leiblum, S., Burnett, A., & Heiman, J. (2002). The Female Sexual Distress Scale (FSDS): Initial validation of a standardized scale for assessment of sexually related personal distress in women. *Journal of Sex & Marital Therapy, 28,* 317–330.

Derogatis, L. R., & Savitz, K. L. (2000). The SCL-90-R and Brief Symptom Inventory (BSI) in primary care. In M. E. Maruish (Ed.), *Handbook of*

psychological assessment in primary care settings (pp. 297–334). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Dewitte, M., & Mayer, A. (2018). Exploring the Link Between Daily Relationship Quality, Sexual Desire, and Sexual Activity in Couples. *Archives of Sexual Behavior, 47,* 1675–1686.

Dimitrov, D. M., & Rumrill, P. D. (2003). Pretest-posttest designs and measurement of change. *Work, 20,* 159–165.

Dogan, S. (2009). Vaginismus and accompanying sexual dysfunctions in a Turkish clinical sample. *Journal of Sexual Medicine*, 6, 184–192.

Duncan, T. E., Duncan, S. C., & Strycker, L. A. (2013). *An introduction to latent variable growth curve modeling: Concepts, issues, and application.* Routledge.

Epskamp, S., Borsboom, D. & Fried, E. I. (2017). Estimating psychological networks and their accuracy: a tutorial paper. *Behavior Research Methods, 50,* 195–212.

Epskamp, S., & Fried, E. I. (2017). A Tutorial on Regularized Partial Correlation Networks. Preprint at https://arxiv.org/abs/1607.01367 v9.

Epskamp, S., Waldorp, L. J., Mõttus, R. & Borsboom, D. (2018). The Gaussian Graphical Model in cross-sectional and time-series data. *Multivariate Behavioral Research, 4,* 453–480.

Finkelstein, F. O., Shirani, S., Wuerth, D., & Finkelstein, S. H. (2007). Therapy Insight: sexual dysfunction in patients with chronic kidney disease. *Nature Clinical Practice Nephrology, 3,* 200–207.

Fisher, A. J., Medaglia, J. D., & Jeronimus, B. F. (2018). Lack of group-to-individual generalizability is a threat to human subjects research. *Proceedings of the National Academy of Sciences, 115,* E6106–E6115.

Fletcher, G. J. O., Simpson, J. A., & Thomas, G. (2000). The measurement of perceived relationship quality components: A confirmatory factor analytic approach. *Personality and Social Psychology Bulletin, 26,* 340–354.

Frühauf, S., Gerger, H., Schmidt, H. M., Munder, T., & Barth, J. (2013). Efficacy of psychological interventions for sexual dysfunction: A systematic review and meta-analysis. *Archives of Sexual Behavior, 42,* 915–933.

Fugl-Meyer, K., & Fugl-Meyer, A .R. (2002). Sexual disabilities are not singularities. *International Journal of Impotence Research, 14,* 487–493.

George, W. H., & Stoner, S. A. (2000). Understanding Acute Alcohol Effects on Sexual Behavior. *Annual Review of Sex Research, 11,* 92–124.

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica, 37,* 424–438.

Graves, G. (2017). *The Problem With 'Female Viagra'.* The Huffington Post. Retrieved from https://www.huffingtonpost.com/entry/the-problem-with-female-viagra_us_5878f624e4b0b3c7a7b0df47?guccounter=1

Gunst, A., Jern, P., Westberg, L., Johansson, A., Salo, B., Burri, A., ... Santtila, P. (2015). A study of possible associations between single nucleotide polymorphisms in the estrogen receptor 2 gene and female sexual desire. *Journal of Sexual Medicine*, *12*, 676–684.

Gunst, A., Nylander, P., Karlsson, L., Ventus, D., & Jern, P. (2018). The effect of having the first child or additional children on female sexual functioning. Manuscript in preparation.

Gunst, A., Ventus, D., Kärnä, A., Salo, P., & Jern, P. (2017). Female sexual function varies over time and is dependent on partner-specific factors: a population-based longitudinal analysis of six sexual function domains. *Psychological Medicine, 47,* 341–352.

Gunst, A., Werner, M., Waldorp, L. J., Laan, E. T. M., Källström, M., & Jern, P. (2018). A network analysis of female sexual function: comparing symptom networks in women with decreased, increased, and stable sexual desire. *Scientific Reports, 8,* 15815.

Günzler, C., & Berner, M. M. (2012). Efficacy of psychosocial interventions in men and women with sexual dysfunctions–a systematic review of controlled clinical trials: part 2–the efficacy of psychosocial interventions for female sexual dysfunction. *Journal of Sexual Medicine, 9,* 3108–3125.

Hällström, T., & Samuelsson, S. (1990). Changes in women's sexual desire in middle life: The longitudinal study of women in Gothenburg. *Archives of Sexual Behavior, 19,* 259–268.

Haslbeck, J. M. B., & Waldorp, L. J. (2018). mgm: estimating time-varying mixed graphical models in high-dimensional data. Preprint at http://arxiv.org/abs/1510.06871 v5.

Hayes, R., & Dennerstein, L. (2005). The impact of aging on sexual function and sexual dysfunction in women: a review of population-based studies. *Journal of Sexual Medicine, 2,* 317–330.

Hawton, K., Catalan, J., & Fagg, J. (1991). Low sexual desire: sex therapy results and prognostic factors. *Behavior Research and Therapy, 29,* 217–224.

Health Canada. (2018). *Notice: Prescription Drug List: Multiple additions.* Retrieved from: https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/prescription-drug-list/notice-multiple-additions-21.html

Hucker, A., & McCabe, M. P. (2015). Incorporating Mindfulness and Chat Groups Into an Online Cognitive Behavioral Therapy for Mixed Female Sexual Problems. *Journal of Sex Research, 52,* 627–639.

Hurlbert, D. F., White, L. C., Powell, R. D., & Apt, C. (1993). Orgasm consistency training in the treatment of women reporting hypoactive sexual desire: An

outcome comparison of women-only groups and couples-only groups. *Journal of Behavior Therapy and Experimental Psychiatry, 24,* 3–13.

IBM Corp. (2013). *IBM statistics for windows, version 22.0.* Armonk, NY: IBM Corp.

Jaspers, L., Feys, F., Bramer, W. M., Franco, O. H., Leusink, P., & Laan, E. T. (2016). Efficacy and safety of flibanserin for the treatment of hypoactive sexual desire disorder in women: A systematic review and meta-analysis. *JAMA Internal Medicine, 176,* 453–462.

Johansson, A., Jern, P., Santtila, P., von der Pahlen, B., Eriksson, E., Westberg, L., ... Sandnabba, N. K. (2013). The Genetics of Sexuality and Aggression (GSA) twin samples in Finland. *Twin Research and Human Genetics 16,* 150–156.

Kabat-Zinn, J. (2005). Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness (15th ed.). New York, NY: Delta/Bantam.

Khajehei, M., Doherty, M., & Tilley, P. (2015). An update on sexual function and dysfunction in women. *Archives of Women's Mental Health, 18,* 423–433.

Kim, N. S. & Ahn, W. K. (2002). Clinical psychologists' theory-based representations of mental disorders predict their diagnostic reasoning and memory. *Journal of Experimental Psychology: General, 131,* 451–476.

Køster, A., & Garde, K. (1993). Sexual desire and menopausal development. A prospective study of Danish women born in 1936. *Maturitas, 16,* 49–60.

Kramer, I., Simons, C. J., Hartmann, J. A., Menne-Lothmann, C., Viechtbauer, W., Peeters, F., ... Wichers, M. (2014). A therapeutic application of the experience sampling method in the treatment of depression: a randomized controlled trial. *World Psychiatry, 13,* 68–77.

Kroeze, R., Van der Veen, D. C., Servaas, M. N., Bastiaansen, J. A., Oude Voshaar, R. C., Borsboom, D., ... Rieser, H. (2017). Personalized feedback on symptom dynamics of psychopathology: A proof-of-principle study. *Journal for Person-Oriented Research, 3,* 1–10.

Laan, E., & Both, S. (2008). What makes women experience desire? *Feminism & Psychology, 18,* 505–514.

Laumann, E. O., Nicolosi, A., Glasser, D. B., Paik, A., Gingell, C., Moreira, E., & Wang, T. (2004). Sexual problems among women and men aged 40–80 y: prevalence and correlates identified in the Global Study of Sexual Attitudes and Behaviors. *International Journal of Impotence Research, 17,* 39–57.

Laumann, E. O., Paik, A., & Rosen, R. C. (1999). Sexual dysfunction in the United States: prevalence and predictors. *JAMA, 281,* 537–544.

Leiblum, S. R. (2002). Reconsidering gender differences in sexual desire: An update. *Sexual and Relationship Therapy*, *17*, 57–68.

Levine, S. B. (2002). Reexploring the concept of sexual desire. *Journal of Sex & Marital Therapy, 28,* 39–51.

Little, T. D. (2013). *Longitudinal Structural Equation Modeling.* New York, NY: Guilford.

Luborsky, L. B., Barrett, M. S., Antonuccio, D. O., Shoenberger, D., & Stricker, G. (2006). What Else Materially Influences What Is Represented and Published as Evidence? In J. C. Norcross, L. E. Beutler, & R. F. Levant (Eds.), *Evidence-based practices in mental health: Debate and dialogue on the fundamental questions* (pp. 257–298). Washington, DC: American Psychological Association.

MacPhee, D. C., Johnson, S. M., & Van der Veer, M. M. (1995). Low sexual desire in women: The effects of marital therapy. *Journal of Sex & Marital Therapy, 21,* 159–182.

Mansfield, P. K., Voda, A., & Koch, P. B. (1995). Predictors of sexual response changes in heterosexual midlife women. *Health Values: The Journal of Health Behavior, Education & Promotion, 19*, 10–20.

Masters, W. H., & Johnson, V. E. (1966). *Human sexual response.* Boston, MA: Little, Brown.

Masters, W. H., & Johnson, V. E. (1970). *Human sexual inadequacy.* Boston, MA: Little, Brown.

McCabe, M. P., & Goldhammer, D. L. (2012). Demographic and Psychological Factors Related to Sexual Desire among Heterosexual Women in a Relationship. *Journal of Sex Research, 49,* 78–87.

McCool, M. E., Zuelke, A., Theurich, M. A., Knuettel, H., Ricci, C., & Apfelbacher, C. (2016). Prevalence of female sexual dysfunction among premenopausal women: a systematic review and meta-analysis of observational studies. *Sexual Medicine Reviews 4,* 197–212.

McHugo, G. J., Drake, R. E., Brunette, M. F., Xie, H., Essock, S. M., & Green, A. I. (2005). Enhancing Validity in Co-occurring Disorders Treatment Research. *Schizophrenia Bulletin, 32,* 655–665.

Meston, C. M. (2003). Validation of the Female Sexual Function Index (FSFI) in women with female orgasmic disorder and in women with hypoactive sexual desire disorder. *Journal of Sex & Marital Therapy, 29,* 39–46.

Meyer-Bahlburg, H. F., & Dolezal, C. (2007). The female sexual function index: a methodological critique and suggestions for improvement. *Journal of Sex & Marital Therapy, 33*, 217–224.

Mintz, L. B., Balzer, A. M., Zhao, X., & Bush, H. E. (2012). Bibliotherapy for low sexual desire: Evidence for effectiveness. *Journal of Counseling Psychology, 59,* 471–478.

Mitchell, K. R., Wellings, K. A., & Graham, C. (2014). How do men and women define sexual desire and sexual arousal? *Journal of Sex & Marital Therapy*, *40*, 17–32.

Muise, A., Boudreau, G. K., & Rosen, N. O. (2017). Seeking Connection Versus Avoiding Disappointment: An Experimental Manipulation of Approach and Avoidance Sexual Goals and the Implications for Desire and Satisfaction. *Journal of Sex Research, 54,* 296–307.

Muthén, B. O. (1989). Factor structure in groups selected on observed scores. *British Journal of Mathematical and Statistical Psychology, 42,* 81–90.

Muthén, L. K., & Muthén, B. O. (1998–2012). *Mplus User's Guide, Seventh Edition*. Los Angeles, CA: Muthén & Muthén.

Naeinian, M. R., Shaeiri, M. R., & Hosseini, F. S. (2011). General health and quality of life in patients with sexual dysfunctions. *Urology Journal, 8,* 127–131.

Nobre, P. J., Pinto-Gouveia, J., & Gomes, F. A. (2006). Prevalence and Comorbidity of Sexual Dysfunctions in a Portuguese Clinical Sample. *Journal of Sex & Marital Therapy, 32,* 173–182.

Nomaguchi, K. M., & Milkie, M. A. (2004). Costs and Rewards of Children: The Effects of Becoming a Parent on Adults' Lives. *Journal of Marriage and Family, 65,* 356–374.

Norman, G. R., Sloan, J. A., & Wyrwich, K. W. (2003). Interpretation of changes in health-related quality of life. The remarkable universality of half a standard deviation. *Medical Care, 41,* 582–592.

Oei, T. P. S., & Green, A. L. (2008). The Satisfaction With Therapy and Therapist Scale – Revised (STTS-R) for group psychotherapy: Psychometric properties and confirmatory factor analysis. *Professional Psychology: Research and Practice, 39,* 435–442.

Oei, T. P. S., & Shuttlewood, G. J. (1999). Development of a Satisfaction With Therapy and Therapist Scale. *Australian and New Zealand Journal of Psychiatry, 33,* 748–753.

Ostovich, J. M. & Sabini, J. (2004). How are sociosexuality, sex drive, and lifetime number of sexual partners related? *Personality and Social Psychology Bulletin, 30,* 1255–1266.

Pakpour, A. H., Yekaninejad, M. S., Pallich, G., & Burri, A. (2015). Using ecological momentary assessment to investigate short-term variations in sexual functioning in a sample of peri-menopausal women from Iran. *PLoS ONE 10,* e0117299.

Palatin Technologies, Inc. (2018). *Palatin Technologies Announces FDA Acceptance for Review of Bremelanotide NDA* [Press release]. Retrieved from https://www.irdirect.net/prviewer/release/id/3127235

Pastor, Z., Holla, K. & Chmel, R. (2013). The influence of combined oral contraceptives on female sexual desire: a systematic review. *European Journal of Contraception & Reproductive Health Care, 18,* 27–43.

Penke, L., & Asendorpf, J. B. (2008). Beyond global sociosexual orientations: A more differentiated look at sociosexuality and its effects on courtship and romantic relationships. *Journal of Personality and Social Psychology, 95,* 1113–1135.

Plomin, R., DeFries, J. C., Knopik, V. S., & Niederhiser, J. M. (2016). Top 10 Replicated Findings From Behavioral Genetics. *Perspectives on Psychological Science, 11,* 3–23.

Prause, N., Janssen, E., & Hetrick, W. P. (2007). Attention and Emotional Responses to Sexual Stimuli and Their Relationship to Sexual Desire. *Archives of Sexual Behavior, 37,* 934–949.

R Core Team (2013). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria.

Reed, B. G., Nemer, L. B., & Carr, B. R. (2016). Has testosterone passed the test in premenopausal women with low libido? A systematic review. *International Journal of Women's Health, 8,* 599–607.

Rosen, R., Brown, C., Heiman, J., Leiblum, S., Meston, C., Shabsigh, R., ... D'Agostino, R. Jr. (2000). The Female Sexual Function Index (FSFI): A multidimensional self-report instrument for the assessment of female sexual function. *Journal of Sex & Marital Therapy, 26,* 191–208.

Santtila, P., Wager, I., Witting, K., Harlaar, K., Jern, P., Johansson, A., ... Sandnabba, N. K. (2007). Discrepancies between sexual desire and sexual activity: gender differences and associations with relationship satisfaction. *Journal of Sex & Marital Therapy, 34,* 31–44.

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 66,* 507–514.

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology, 4,* 1–32.

Shifren, J. L., Monz, B. U., Russo, P. A., Segreti, A., & Johannes, C. B. (2008). Sexual problems and distress in United States women: Prevalence and correlates. *Obstetrics & Gynecology, 112,* 970–978.

Simon, J., Braunstein, G., Nachtigall, L., Utian, W., Katz, M., Miller, S., ... Davis, S (2005). Testosterone patch increases sexual activity and desire in surgically menopausal women with hypoactive sexual desire disorder. *Journal of Clinical Endocrinology & Metabolism, 90,* 5226–5233.

Simpson, J. A., & Gangestad, S. W. (1991). Individual differences in sociosexuality: evidence for convergent and discriminant validity. *Journal of Personality and Social Psychology, 60,* 870–883.

Spanier, G. B. (1976). Measuring dyadic adjustment: New scales for assessing the quality of marriage and similar dyads. *Journal of Marriage and the Family, 38,* 15–28.

Spector, I. P., Carey, M. P., & Steinberg, L. (1996). The sexual desire inventory: development, factor structure, and evidence of reliability. *Journal of Sex & Marital Therapy,* 22, 175–190.

Stahl, S. M., Sommer, B., & Allers, K. A. (2011). Multifunctional pharmacology of flibanserin: possible mechanism of therapeutic action in hypoactive sexual desire disorder. *Journal of Sexual Medicine, 8,* 15–27.

Stephenson, K. R., & Kerth, J. (2017). Effects of mindfulness-based therapies for female sexual dysfunction: A meta-analytic review. *Journal of Sex Research, 54,* 832–849.

Stephenson, K. R., & Meston, C. M. (2010). Differentiating Components of Sexual Well-Being in Women: Are Sexual Satisfaction and Sexual Distress Independent Constructs? *Journal of Sexual Medicine, 7,* 2458–2468.

Toates, F. (2009). An integrative theoretical framework for understanding sexual motivation, arousal, and behavior. *Journal of Sex Research, 46,* 168–193.

Trudel, G., Landry, L., & Larose, Y. (1997). Low sexual desire: The role of anxiety, depression and marital adjustment. *Sexual & Marital Therapy, 12,* 95–99.

Trudel, G., Marchand, A., Ravart, M., Aubin, S., Turgeon, L., & Fortier, P. (2001). The effect of a cognitive-behavioral group treatment program on hypoactive sexual desire in women. *Sex and Relationship Therapy, 16,* 145–164.

U.S. Food and Drug Administration. (2015). *Novel Drug Approvals for 2015.* Retrieved from https://www.fda.gov/Drugs/DevelopmentApprovalProcess/ DrugInnovation/ucm430302.htm

van Borkulo, C. D. (2017). *Network Comparison Test: Permutation-based test of differences in strength of networks.* Retrieved from https://github.com/ cvborkulo/NetworkComparisonTest.

Ventus, D., Gunst, A., Arver, S., Dhejne, C., Görts-Öberg, K., Zamore- Söderström, E., ... Jern, P. (under review). Vibrator-assisted start-stop exercises improve premature ejaculation symptoms: A randomized controlled trial. Springer US.

Ventus, D., Ristilä, M., Gunst, A., Kärnä, A., Arver, S., Piha, J., & Jern, P. (2017). A Longitudinal Analysis of Premature Ejaculation Symptoms Raises Concern Regarding the Appropriateness of a "Lifelong" Subtype. *European Urology Focus, 3,* 243–245.

Ward, P. J., Lundberg, N. R., Zabriskie, R. B., & Berrett, K. (2009). Measuring Marital Satisfaction: A Comparison of the Revised Dyadic Adjustment Scale and the Satisfaction with Married Life Scale. *Marriage & Family Review, 45,* 412–429.

Wiegel, M., Meston, C., & Rosen, R. (2005). The Female Sexual Function Index (FSFI): cross-validation and development of clinical cutoff scores. *Journal of Sex & Marital Therapy, 31,* 1–20.

Wigman, J. T. W., van Os, J., Thiery, E., Derom, C., Collip, D., Jacobs, N., & Wichers, M. (2013). Psychiatric Diagnosis Revisited: Towards a System of Staging and Profiling Combining Nomothetic and Idiographic Parameters of Momentary Mental States. *PLoS ONE, 8,* e59559.

Witting, K. (2008). *Classification, Comorbidity, Heredity, and Risk Factors of Female Sexual Dysfunctions.* Åbo Akademi University: Turku, Finland.

Witting, K., Santtila, P., Alanko, K., Harlaar, N., Jern, P., Johansson, A., ... Sandnabba, N. K. (2008). Female sexual function and its association with number of children, pregnancy and relationship satisfaction. *Journal of Sex & Marital Therapy, 34,* 89–106.

Witting, K., Santtila, P., Jern, P., Varjonen, M., Wager, I., Höglund, M., ... Sandnabba, N. K. (2008). Evaluation of the Female Sexual Function Index in a population based sample from Finland. *Archives of Sexual Behaviors, 37,* 912–924.

Witting, K., Santtila, P., Rijsdijk, F., Varjonen, M., Jern, P., Johansson, A., ... Sandnabba, N. K. (2009). Correlated genetic and non-shared environmental influences account for the co-morbidity between female sexual dysfunctions. *Psychological Medicine, 39,* 115–127.

Witting, K., Santtila, P., Varjonen, M., Jern, P., Johansson, A., von der Pahlen, B., Sandnabba, K. (2008). Female sexual dysfunction, sexual distress, and compatibility with partner. *Journal of Sexual Medicine, 5,* 2587–2599.

Woertman, L. & van den Brink, F. (2012). Body image and female sexual functioning and behavior: a review. *Journal of Sex Research, 49,* 184–211.

World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines.* Geneva: World Health Organization.

World Health Organization. (2016). F52 Sexual dysfunction, not caused by organic disorder or disease. In *ICD-10 Version:2016.* Retrieved from https://icd.who.int/browse10/2016/en

World Health Organization. (2018). *WHO releases new International Classification of Diseases (ICD 11)* [Press release]. Retrieved from https://www.who.int/news-room/detail/18-06-2018-who-releases-new-international-classification-of-diseases-(icd-11)

Yeniel, A. O., & Petri, E. (2014). Pregnancy, childbirth, and sexual function: Perceptions and facts. *International Urogynecology Journal, 25,* 5–14.

Zivadinov, R., Zorzon, M., Bosco, A., Monti Bragadin, L., Moretti, R., Bonfigli, L., ... Cazzato, G. (1999). Sexual dysfunction in multiple sderosis: II. Correlation analysis. *Multiple Sclerosis, 5,* 428–431.

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